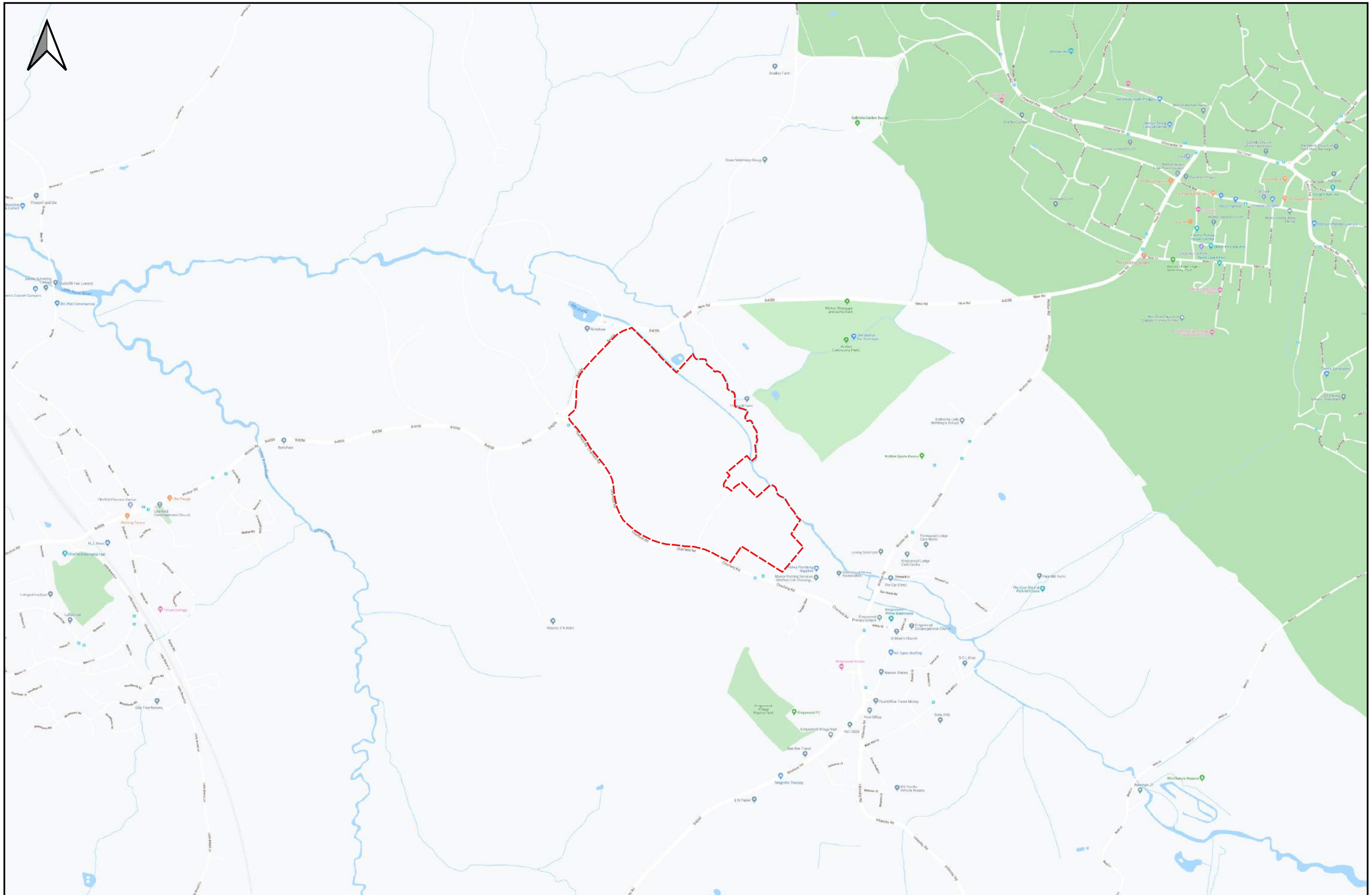


Appendix A

Site Information

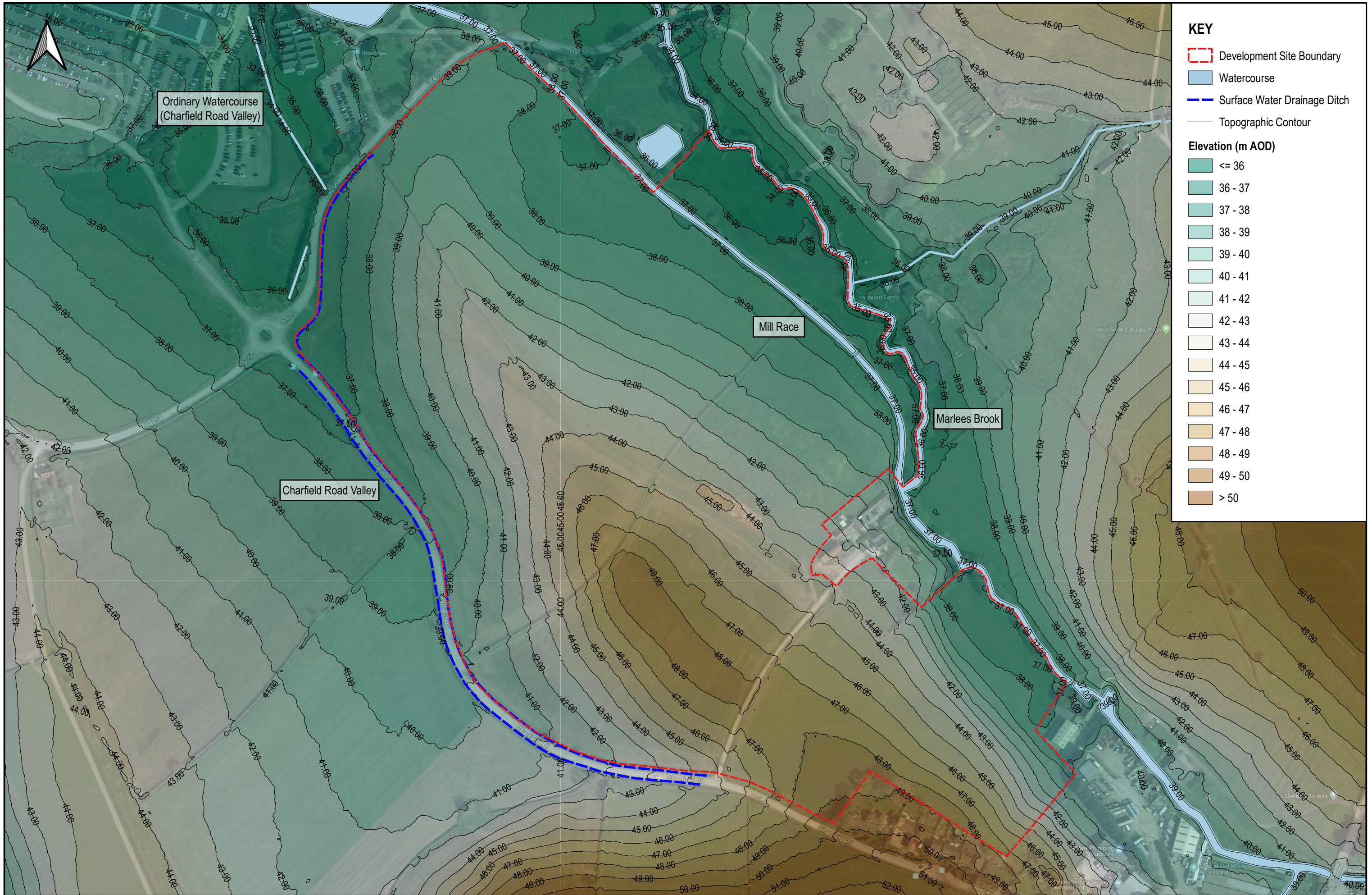


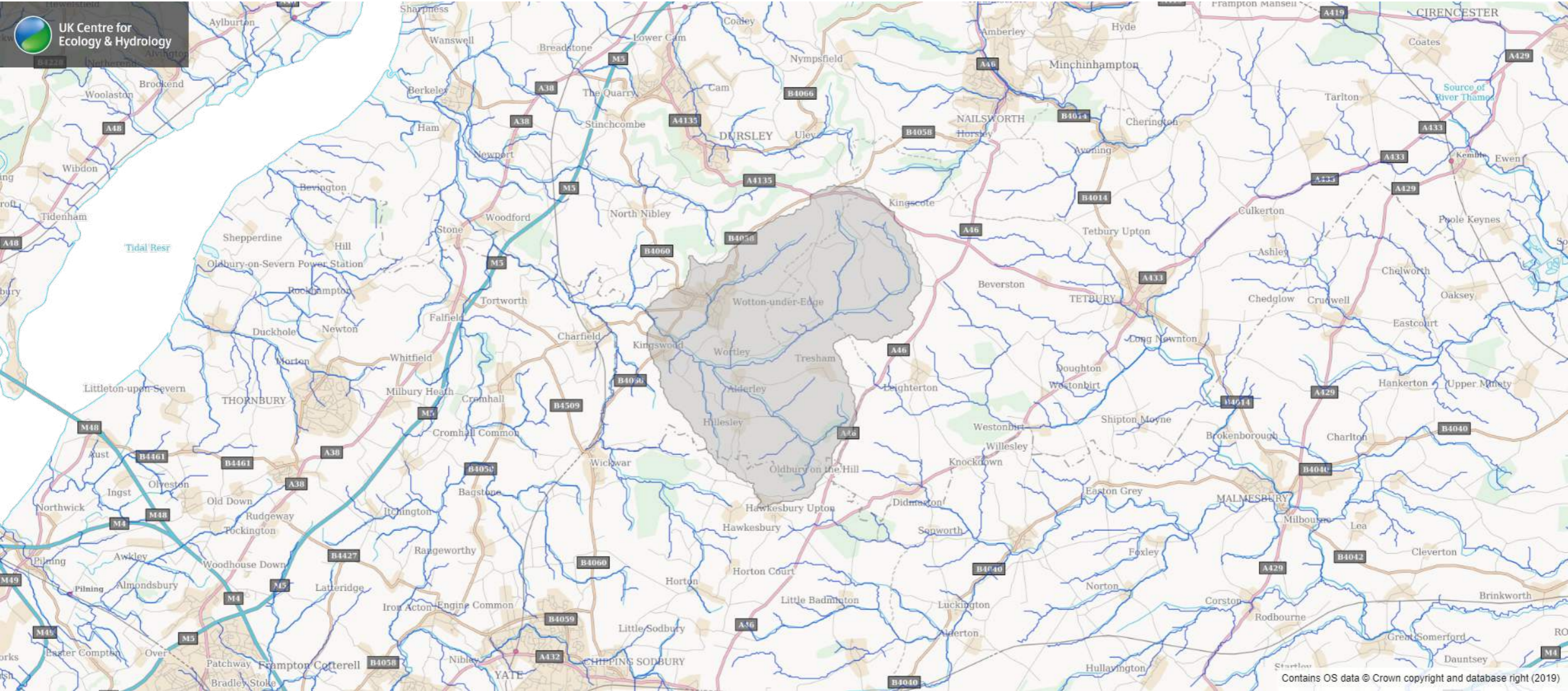


Job: Kingswood, Wotton-under-Edge

Title: Site Location

Scale @ A3: 1:10,000





Surface Geology | 3D Models | Borehole Scans | Earthquake Timeline

Surface Geology

- Superficial only
- Bedrock only
- Bedrock and Superficial

Visible geology:
1:50 000 scale

Geology Key

[More on digital geology.](#)

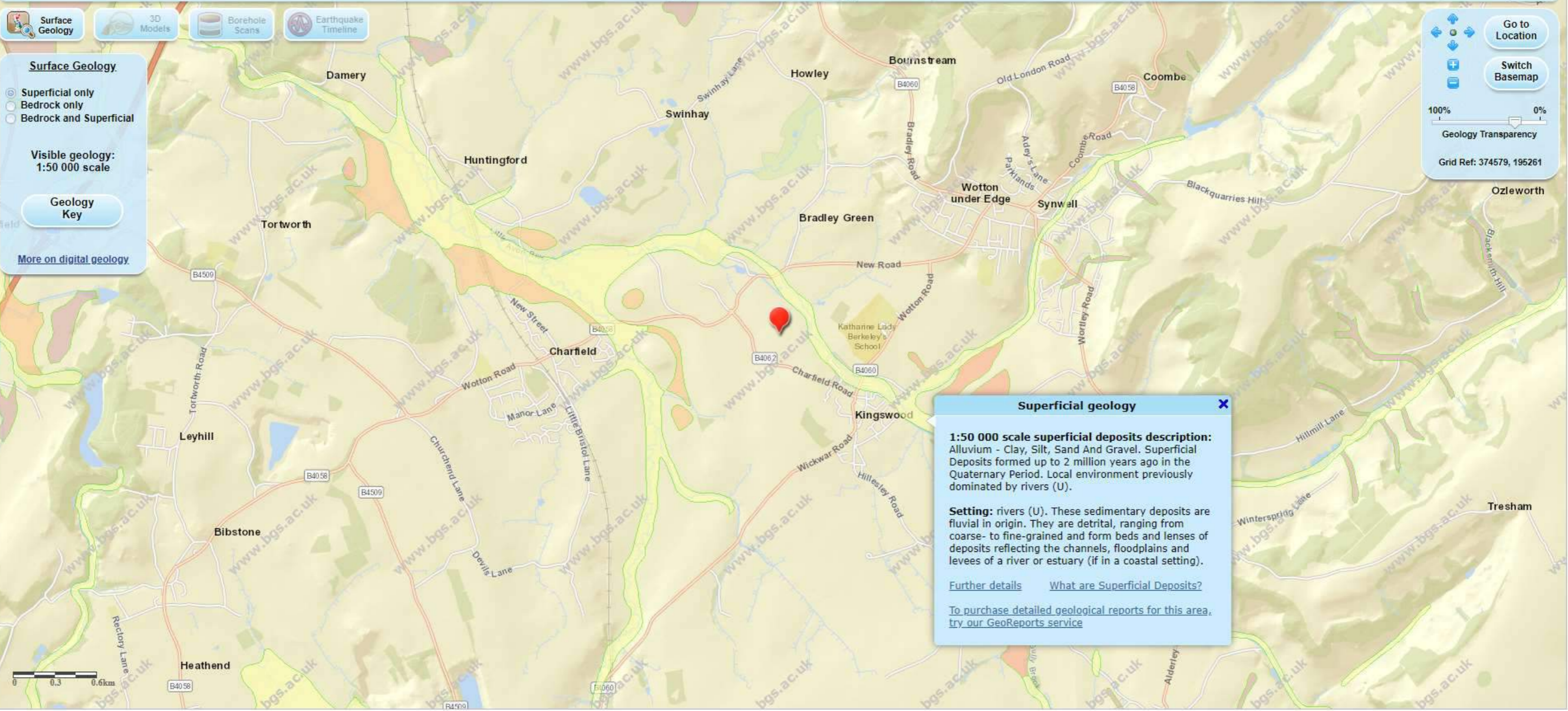
Go to Location

Switch Basemap

100% 0%

Geology Transparency

Grid Ref: 374579, 195261



Superficial geology X

1:50 000 scale superficial deposits description:
Alluvium - Clay, Silt, Sand And Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers (U).

Setting: rivers (U). These sedimentary deposits are fluvial in origin. They are detrital, ranging from coarse- to fine-grained and form beds and lenses of deposits reflecting the channels, floodplains and levees of a river or estuary (if in a coastal setting).

[Further details](#) [What are Superficial Deposits?](#)

[To purchase detailed geological reports for this area, try our GeoReports service](#)

- Surface Geology
- 3D Models
- Borehole Scans
- Earthquake Timeline

Surface Geology

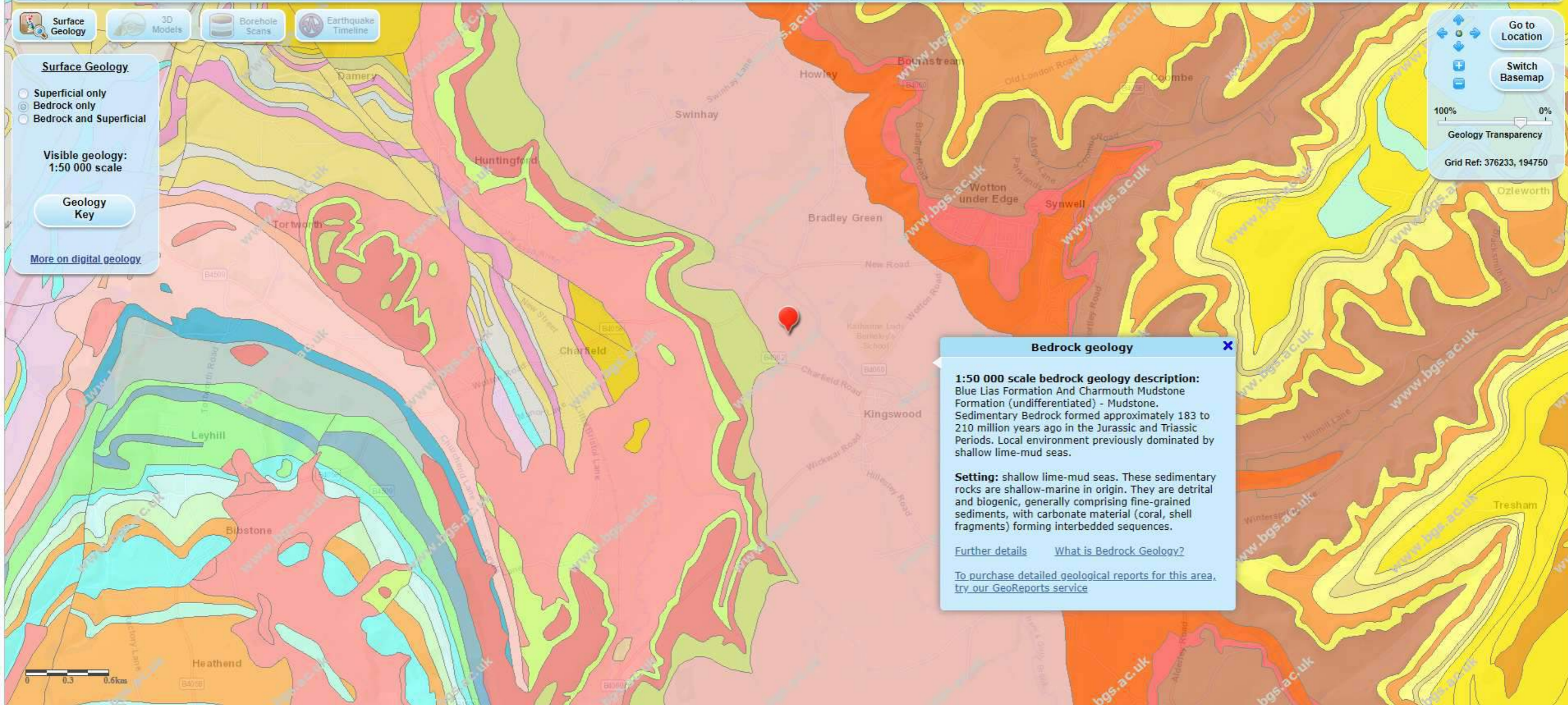
- Superficial only
- Bedrock only
- Bedrock and Superficial

Visible geology:
1:50 000 scale

Geology Key

[More on digital geology.](#)

Navigation controls: Go to Location, Switch Basemap, 100% to 0% zoom, Geology Transparency slider, Grid Ref: 376233, 194750



Bedrock geology

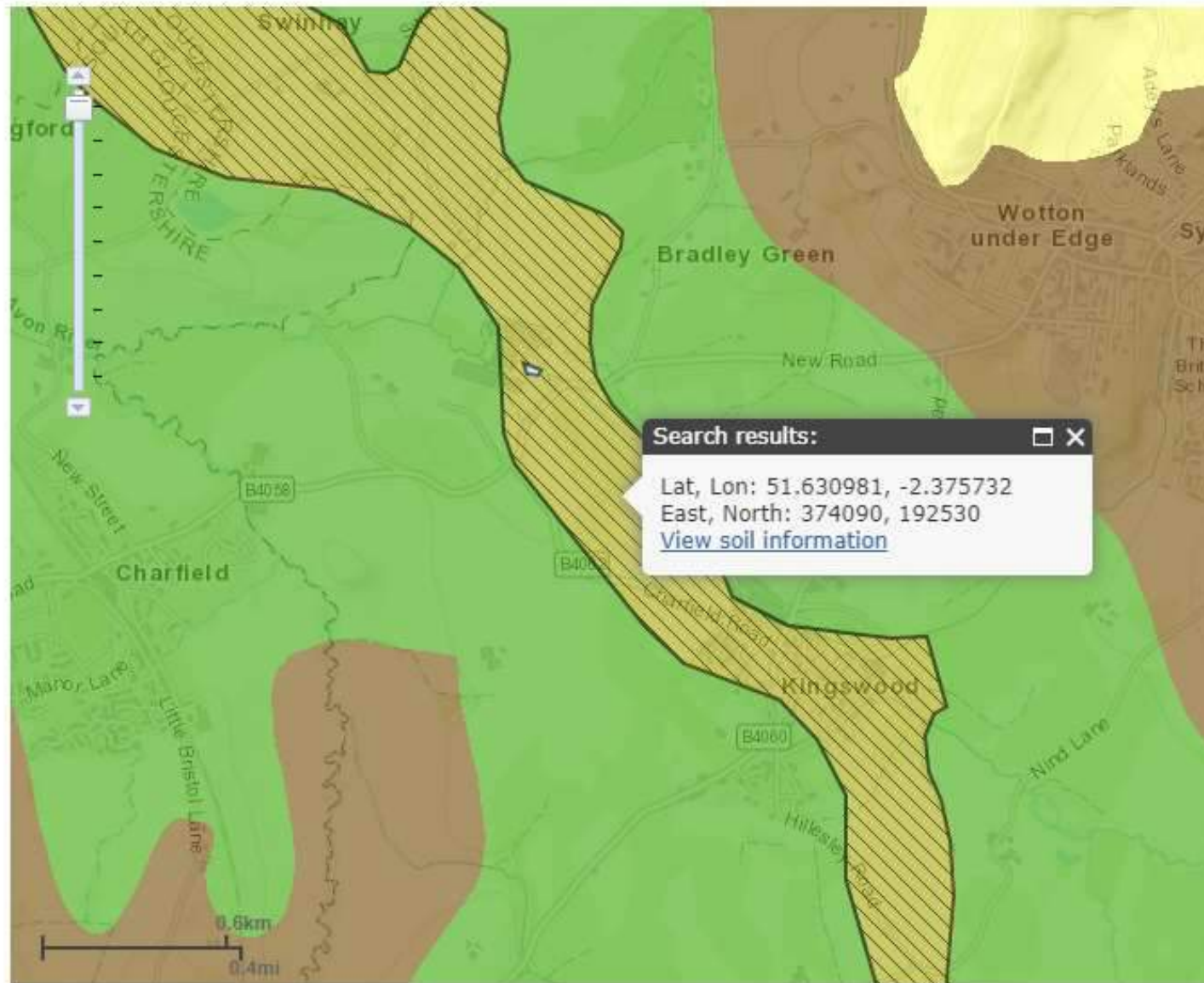
1:50 000 scale bedrock geology description:
Blue Lias Formation And Charmouth Mudstone Formation (undifferentiated) - Mudstone.
Sedimentary Bedrock formed approximately 183 to 210 million years ago in the Jurassic and Triassic Periods. Local environment previously dominated by shallow lime-mud seas.

Setting: shallow lime-mud seas. These sedimentary rocks are shallow-marine in origin. They are detrital and biogenic, generally comprising fine-grained sediments, with carbonate material (coral, shell fragments) forming interbedded sequences.

[Further details](#) [What is Bedrock Geology?](#)

[To purchase detailed geological reports for this area, try our GeoReports service](#)

Scale bar: 0, 0.3, 0.6km



Search results:

Lat, Lon: 51.630981, -2.375732
 East, North: 374090, 192530
[View soil information](#)

Legend

Search

Soil information

Soilscape 9:
 Lime-rich loamy and clayey soils with impeded drainage

Texture: ?
 Clayey, some loamy

Coverage:
 England: 5.3% Wales: 0%
 England & Wales: 4.5%

Selected area:
 4.1km²

Drainage: ?
 Slightly impeded drainage

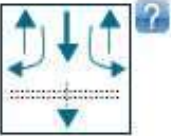
Fertility: ?
 High

Habitats: ?
 Base-rich pastures and classic chalky boulder clay ancient woodlands; some wetter areas and lime-rich flush vegetation

Landcover: ?
 Arable some grassland

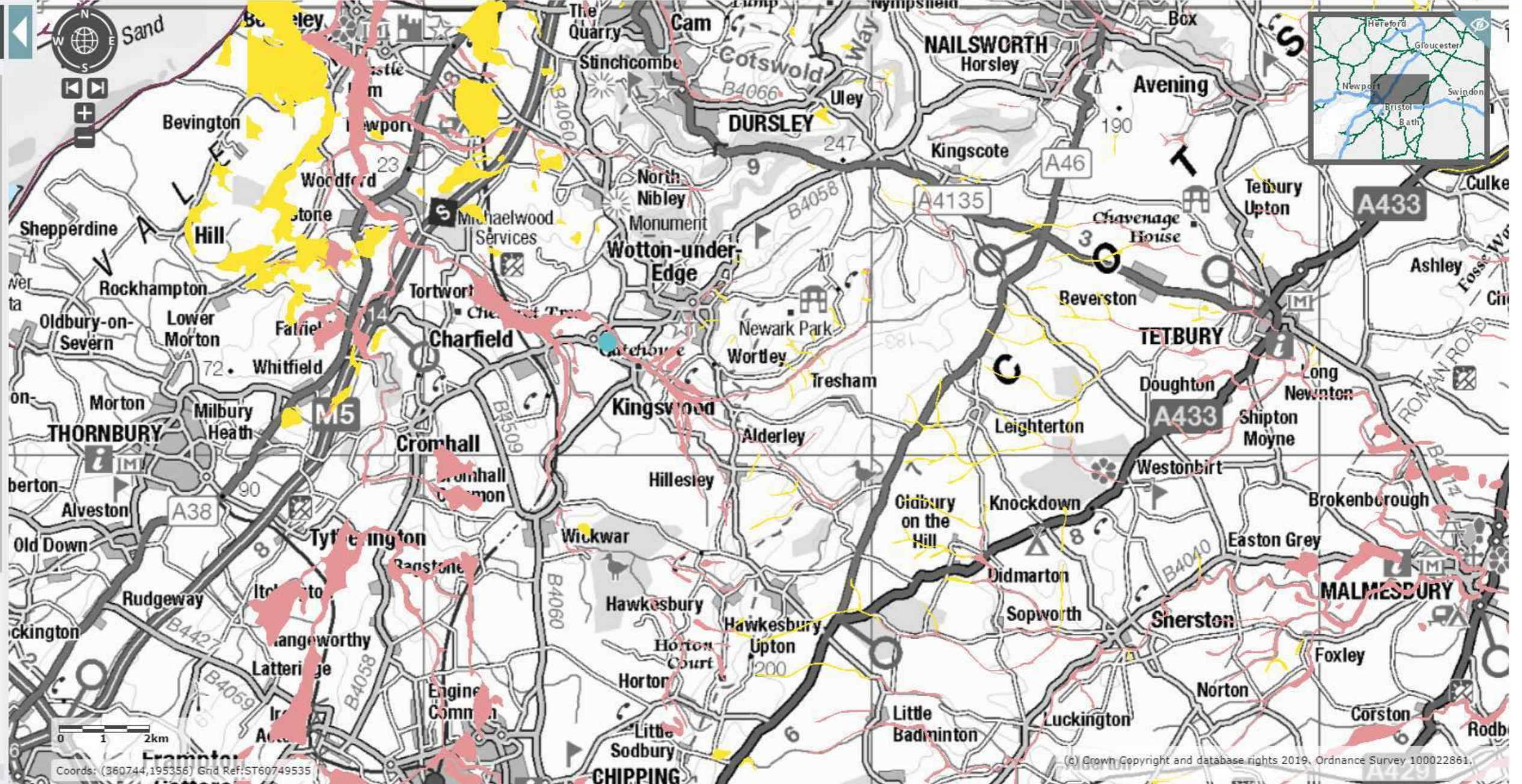
Carbon:
 Low

Drains to:



Adjust transparency

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 - Designations
 - Habitats and Species
 - Land Based Schemes
 - Landscape
 - Geology and Soils
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 - Aquifer Designation Map (Superficial Drift) (England)
 - Principal
 - Secondary A
 - Secondary B
 - Secondary (undifferentiated)
 - Unknown (lakes+landslip)
 - Unproductive
 - Groundwater Vulnerability Map (England)
 - Geological Places to Visit (England)
 - Geological Descriptions (England)
 - Soilscape (England)
 - Landscape Classifications



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 - Groundwater Vulnerability Map (England)
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 - Geological Descriptions (England)
 - Soilscape (England)
 - Landscape Classifications
 - Marine



Appendix B

Flood Risk Information





KEY

- Development Site Boundary
- Watercourse
- Surface Water Drainage Ditch

Flood Zones

- Flood Zone 2
- Flood Zone 3

Ordinary Watercourse
(Charfield Road Valley)

Mill Race

Marlees Brook

Charfield Road Valley

GCC Flooding



SHOW LAYERS

Background Mapping +

Flooding -

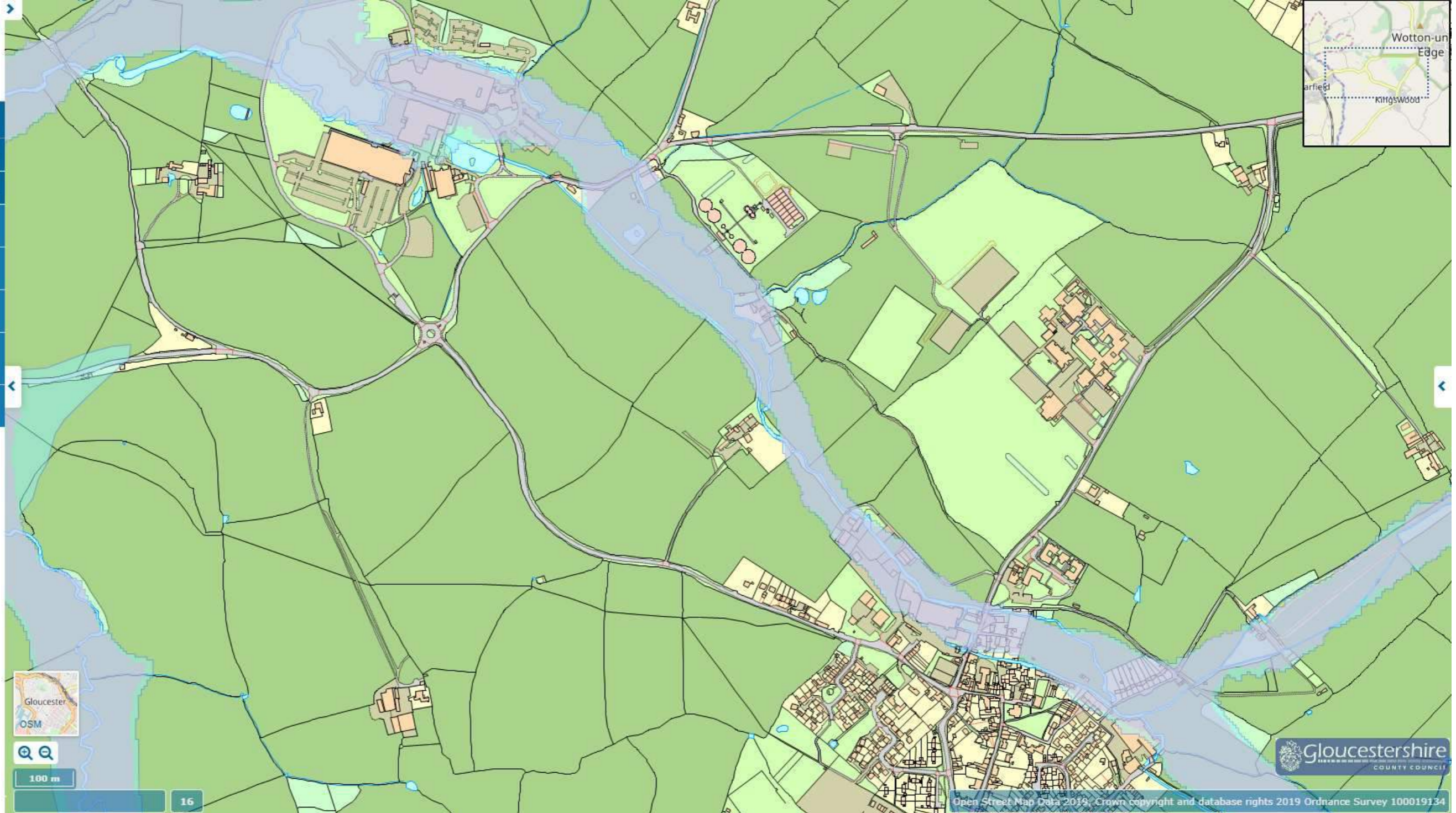
Contours

SFRA Level 1 Flood Zone 3b

SFRA Level 1 Flood Zone 3a

SFRA Level 1 Flood Zone 3aCC

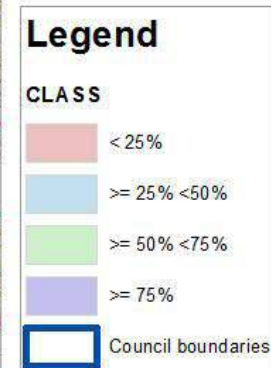
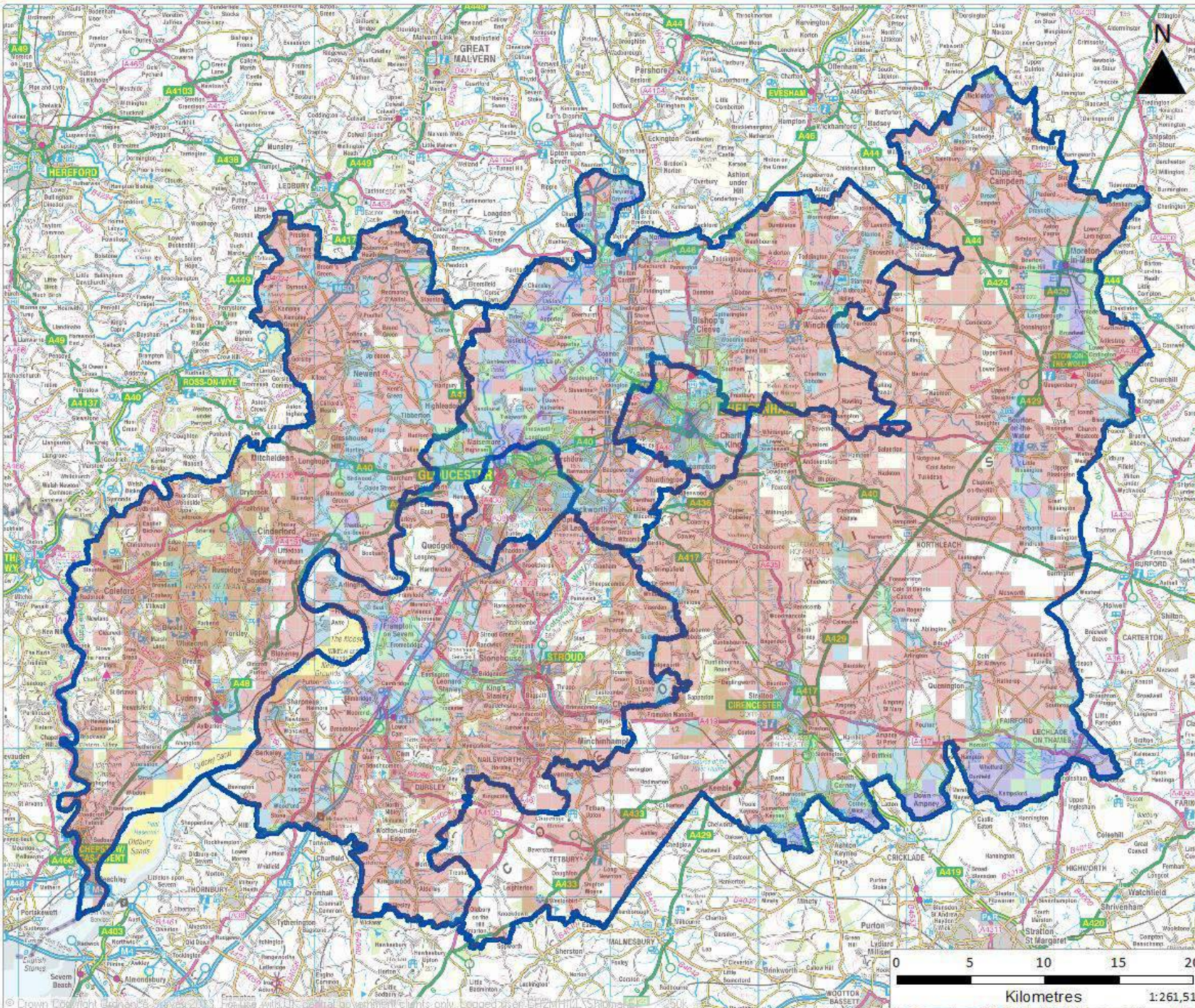
SFRA Level 1 Flood Zone 2





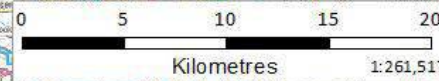


Gloucestershire County Council LFRMS



Areas susceptible to groundwater flooding

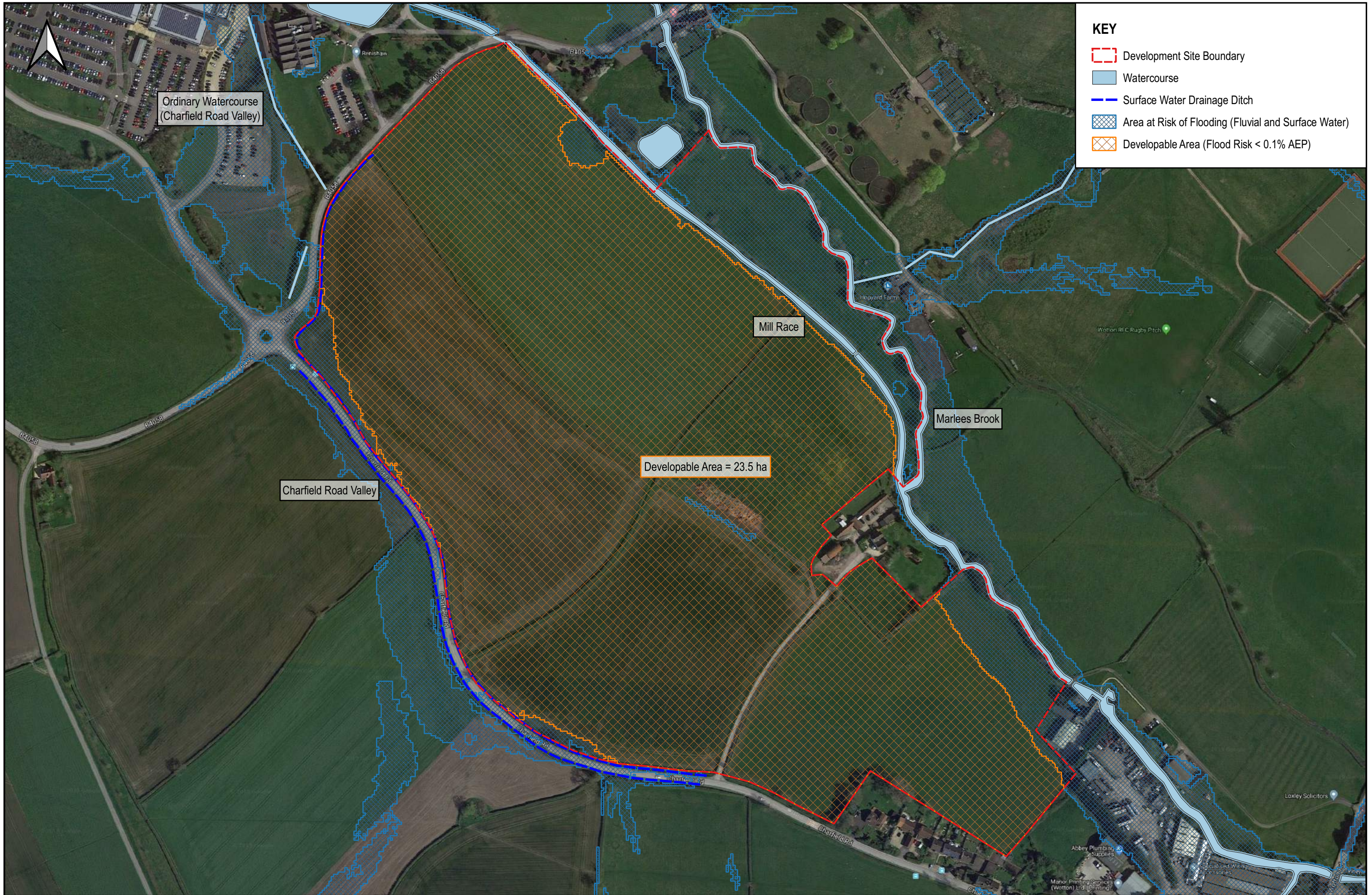
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Appendix C

Flood Risk Management Measures






Appendix D

Conceptual Surface Water Drainage Strategy



JNP Group		Page 1
3rd Floor, Marlborough House 48 Holly Walk Leamington Spa CV32 4XP	Kingswood, Wotton-under-Edge Sustainable Drainage Strategy Greenfeld Runoff Rates	
Date 19/12/2019 13:35 File	Designed by JNP Group Checked by RM	
Micro Drainage	Source Control 2018.1.1	

ICP SUDS Mean Annual Flood

Input

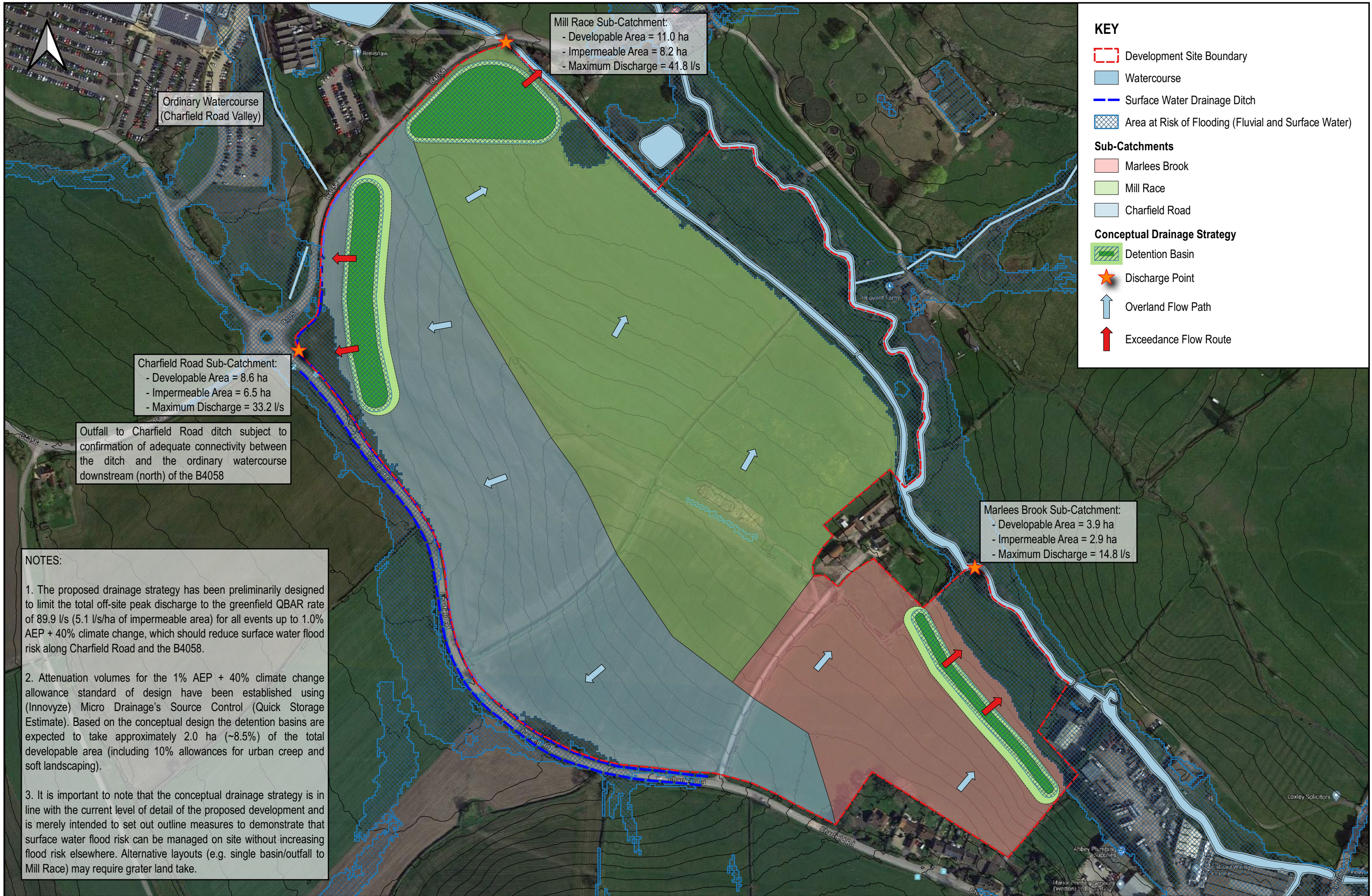
Return Period (years) 5 SAAR (mm) 800 Urban 0.000
Area (ha) 1.000 Soil 0.450 Region Number Region 4

Results 1/s

QBAR Rural 5.1
QBAR Urban 5.1

Q5 years 6.3

Q1 year 4.3
Q30 years 10.1
Q100 years 13.2



Mill Race Sub-Catchment:
 - Developable Area = 11.0 ha
 - Impermeable Area = 8.2 ha
 - Maximum Discharge = 41.8 l/s

Ordinary Watercourse (Charfield Road Valley)

Charfield Road Sub-Catchment:
 - Developable Area = 8.6 ha
 - Impermeable Area = 6.5 ha
 - Maximum Discharge = 33.2 l/s

Outfall to Charfield Road ditch subject to confirmation of adequate connectivity between the ditch and the ordinary watercourse downstream (north) of the B4058

Marlees Brook Sub-Catchment:
 - Developable Area = 3.9 ha
 - Impermeable Area = 2.9 ha
 - Maximum Discharge = 14.8 l/s

KEY

- Development Site Boundary
- Watercourse
- Surface Water Drainage Ditch
- Area at Risk of Flooding (Fluvial and Surface Water)

Sub-Catchments

- Marlees Brook
- Mill Race
- Charfield Road

Conceptual Drainage Strategy

- Detention Basin
- ★ Discharge Point
- ↑ Overland Flow Path
- ↑ Exceedance Flow Route

NOTES:

1. The proposed drainage strategy has been preliminarily designed to limit the total off-site peak discharge to the greenfield QBAR rate of 89.9 l/s (5.1 l/s/ha of impermeable area) for all events up to 1.0% AEP + 40% climate change, which should reduce surface water flood risk along Charfield Road and the B4058.
2. Attenuation volumes for the 1% AEP + 40% climate change allowance standard of design have been established using (Innovyze) Micro Drainage's Source Control (Quick Storage Estimate). Based on the conceptual design the detention basins are expected to take approximately 2.0 ha (~8.5%) of the total developable area (including 10% allowances for urban creep and soft landscaping).
3. It is important to note that the conceptual drainage strategy is in line with the current level of detail of the proposed development and is merely intended to set out outline measures to demonstrate that surface water flood risk can be managed on site without increasing flood risk elsewhere. Alternative layouts (e.g. single basin/outfall to Mill Race) may require greater land take.



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sheffield@jnpgroup.co.uk



APPENDIX E – PRELIMINARY ECOLOGICAL APPRAISAL



Ecological Constraints and Opportunities Report

Charfield Road, Kingswood, Gloucestershire

(central OS grid reference: ST 740 925)

A report on behalf of Redrow Homes

Ref: 1011-ECOR-FM

www.ge-consulting.co.uk - 01647 253652 - info@ge-consulting.co.uk

GE Consulting is a trading name for GE Consulting Services (UK) Ltd registered number 08435536
Registered office: Unit 11A, Gidleys Meadow Business Park, Christow, Devon, EX6 7QB. VAT Number 160595992

1. Introduction

This document has been produced by GE Consulting on behalf of Redrow Homes to provide preliminary ecological constraints and opportunities at this site.

Note that this document aims to provide design and planning advice prior to further surveys that may be required, and it is not intended to be submitted with a planning application to develop the Site. However, recommendations have been provided below with a view to support and enhance any future applications.

2. Site Survey

The survey comprised an Extended Phase 1 Habitat Survey and habitat condition assessment undertaken on 23 December 2019 and 13 October 2020, supplemented by a desk-based study, whereby biological data was obtained from the Gloucestershire Centre for Environmental Records (GCER). This survey identified the potential for protected species for which surveys need undertaking (see **Section 5**).

3. Results

Figure 1 shows the survey area and identifies key constraints as well as opportunities to avoid, mitigate and enhance key ecological features.

Table 1 provides more detail of issues for consideration. In summary, recommendations are made to ensure the design meets nature legislation and the principles of the NPPF and local policy, including:

- 🔥 Sites of importance to wildlife should be safeguarded, e.g. SACs/ SPAs, SSSIs, locally designated sites and ecological networks/ corridors;
- 🔥 Developments should apply the mitigation hierarchy: avoid, mitigate, compensate;
- 🔥 Avoid loss of irreplaceable habitat e.g. ancient woodland or trees;
- 🔥 Conservation and enhancement of biodiversity is supported, especially where this secures measurable net gains for biodiversity.

4. Biodiversity Net Gain (BNG)

The Government are planning to roll out a requirement for achieving a 10% net gain in biodiversity for all developments once the Environment Bill is enacted. This 10% gain relates to both linear habitats (e.g. hedgerows) and non-linear habitats (e.g. grassland/woodland) and requires the use of a 'metric' to calculate the required biodiversity units. Some LPA's already request the use of the metric through current or emerging policies. For this site, the use of the metric should be confirmed with the LPA ecologist.

Habitats of high 'distinctiveness' should be targeted for retention such as hedgerows, woodland and watercourses and new habitats with high distinctiveness can be created to provide net gains. Offsite measures may be acceptable through legal agreements but should only be sought once all on-site options have been explored.

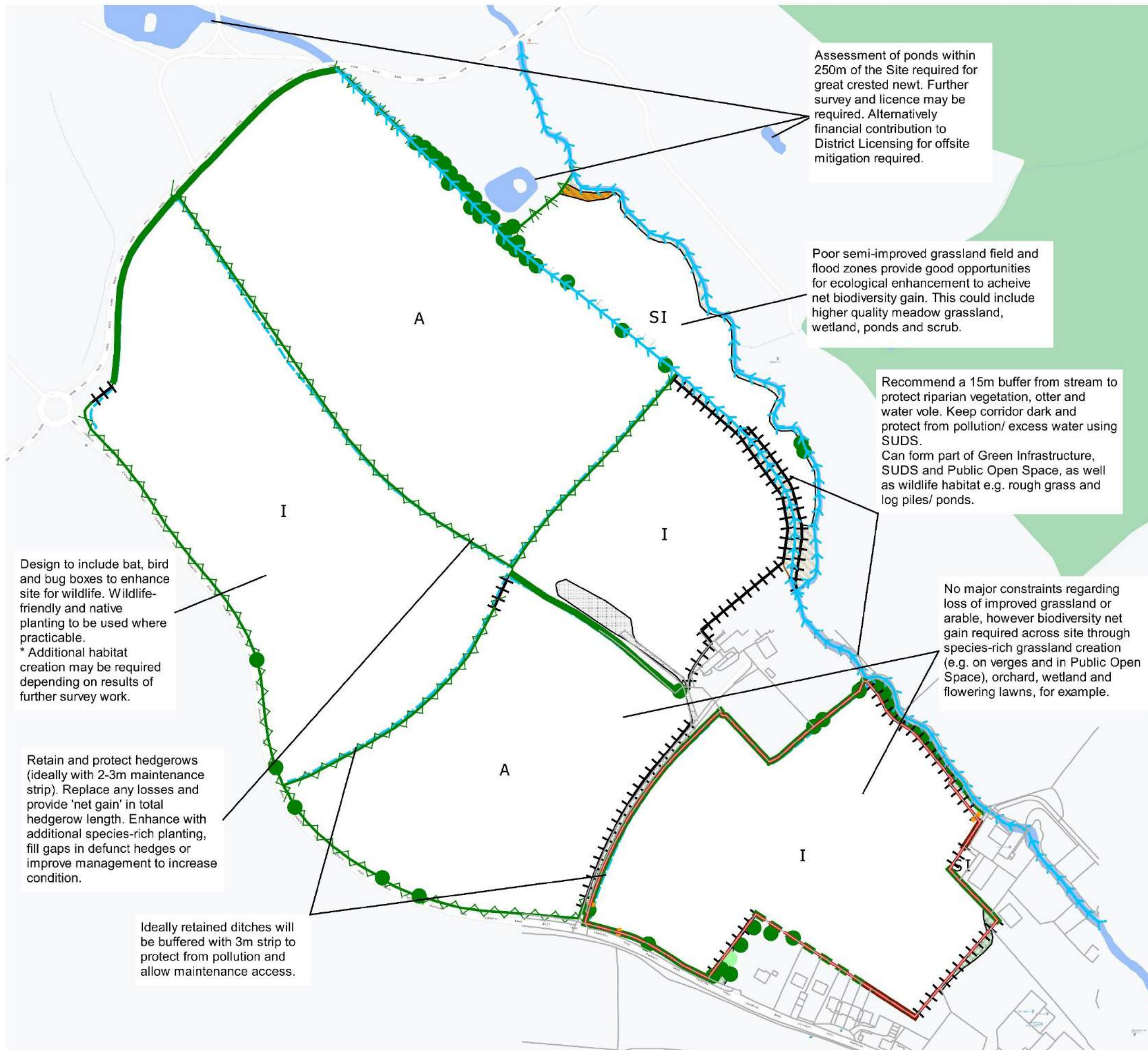
Refer to **Tables 2 & 3** for an indication of the BNG requirements on this Site.

5. Further Survey Work

The timeline below shows the further ecological survey work that would be expected to accompany a planning application and to inform suitable mitigation.

TASK	Mar	April	May	June	July	August	Sept	Oct
Breeding birds								
Commuting/ foraging bats – (1 transect walked monthly & 5 static automated bat detectors per visit, for 5 nights)								
Reptiles (8 visits, approx. 50 refugia)				Sub-optimal				
Dormouse survey (100 tubes April/ May to August/ September)								
Great crested newt survey (<u>or</u> enter District Licensing Scheme to avoid survey)								
Riparian mammal survey (2 visits, one April-June, one July – Sept)								
Liaison with LPA and District Licensing Scheme								
Ecological Impact Assessment for Planning Application, including BNG Assessment								

Many of these surveys are seasonally constrained and therefore ecological advice early in the project programme is always recommended. However, if there are conflicts with the project timetable, please speak to a member of the team at GE Consulting at an early stage and we will make every effort to find a pragmatic approach that works within your time frame if possible.



Assessment of ponds within 250m of the Site required for great crested newt. Further survey and licence may be required. Alternatively financial contribution to District Licensing for offsite mitigation required.

Poor semi-improved grassland field and flood zones provide good opportunities for ecological enhancement to achieve net biodiversity gain. This could include higher quality meadow grassland, wetland, ponds and scrub.

Recommend a 15m buffer from stream to protect riparian vegetation, otter and water vole. Keep corridor dark and protect from pollution/ excess water using SUDS. Can form part of Green Infrastructure, SUDS and Public Open Space, as well as wildlife habitat e.g. rough grass and log piles/ ponds.

No major constraints regarding loss of improved grassland or arable, however biodiversity net gain required across site through species-rich grassland creation (e.g. on verges and in Public Open Space), orchard, wetland and flowering lawns, for example.

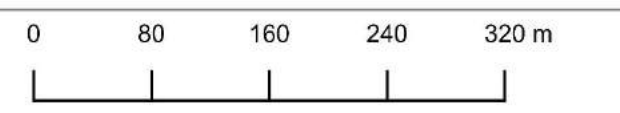
Design to include bat, bird and bug boxes to enhance site for wildlife. Wildlife-friendly and native planting to be used where practicable. * Additional habitat creation may be required depending on results of further survey work.

Retain and protect hedgerows (ideally with 2-3m maintenance strip). Replace any losses and provide 'net gain' in total hedgerow length. Enhance with additional species-rich planting, fill gaps in defunct hedges or improve management to increase condition.

Ideally retained ditches will be buffered with 3m strip to protect from pollution and allow maintenance access.

Legend

- A Arable
- SI Poor Semi-improved Grassland
- Marsh Grassland
- I Improved Grassland
- Semi-natural Broad-leaved Woodland
- Dense/Continuous Scrub
- Tall Ruderal
- Scattered Broad-leaved Trees
- Scattered Coniferous Trees
- ▲ Native Species-rich Hedge
- ▲ Native Species-rich Hedge with Trees
- Species-poor Hedge
- Defunct Species-poor Hedge
- Running Water
- Fence
- Brick Wall
- Dry Ditch
- Wet Ditch
- Mammal Track



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Figure 1: Ecological Constraints & Opportunities Plan	
Project: Charfield Road, Kingswood	
Client: Redrow Homes	
Date: 3/11/2020	Ref: 1011-ECOP-F1
Version: 3	Drawn by: SL/FM



Table 1: Potential Constraints and Opportunities Related to Development of Site

Ecological Receptor	Constraints and Likely Impacts During Construction and Operation	Recommended Enhancements	Mitigation, Opportunities and
Designated Sites			
Natura 2000 sites within 10km: <ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> N/A 	N/A	
Statutory sites within 2km: <ul style="list-style-type: none"> Wotton Hill Site of Special Scientific Interest (SSSI), 1.4km north-east <p>The Site is within an Impact Risk Zone for this SSSI; Natural England will be consulted for 'All planning applications (except householder) outside or extending outside existing settlements/urban areas affecting greenspace, farmland, semi natural habitats' etc.</p> <ul style="list-style-type: none"> Cullimore's Quarry SSSI, 1.6km west 	<ul style="list-style-type: none"> Wotton Hill is designated for ancient beech woodland, unimproved limestone grassland and the rare Schedule 8 plant: limestone woundwort <i>Stachys alpina</i>. The SSSI is in largely favourable condition but could be sensitive to trampling and changes in management. Cullimore's Quarry is designated due to geological interest and is not considered further in this report. 		<ul style="list-style-type: none"> Include good quality, linked and naturalistic Public Open Space (POS) as part of design, to provide recreational opportunities within the site itself. Ensure that no impacts arise during construction (e.g. through Construction Environmental Management Plan (CEMP)).
Non-statutory sites within 2km: Nind Trout Farm & Ozleworth Brook Local Wildlife Site (LWS) and Wildlife Trust Reserve (765m upstream)	<ul style="list-style-type: none"> A residential scheme in this location has the potential to increase recreational pressure to this LWS. No pollution impacts are anticipated as the LWS is upstream. 		<ul style="list-style-type: none"> Include good quality, linked and naturalistic Public Open Space (POS) as part of design, to provide recreational opportunities within the site itself. Protect watercourse (e.g. buffer and keep dark) to maintain water vole/ otter populations in the local area (see also FAUNA).
Habitats			
Improved grassland	<ul style="list-style-type: none"> No major constraints – low value botanically and low distinctiveness. Compensatory habitat creation required under new Biodiversity Net Gain (BNG) Metric. 		<ul style="list-style-type: none"> Scope to provide net gain by creating areas of species-rich grassland (especially along watercourse and hedgerows), flowering lawns on road verges and other higher quality habitat such as orchards. POS provides good opportunities for providing recreational space as well as informal areas with wildlife value.
Poor semi-improved and marshy grassland	<ul style="list-style-type: none"> Low lying land between watercourses; likely to flood. Low value botanically but good potential for enhancement. Compensatory habitat creation required under new BNG Metric if lost. 		<ul style="list-style-type: none"> Good potential to enhance this area with wetland, ponds, rough grassland and scrub, providing net gain for the site and providing an area for wildlife.

Ecological Receptor	Constraints and Likely Impacts During Construction and Operation	Recommended Mitigation, Opportunities and Enhancements
River corridor and ditches	<ul style="list-style-type: none"> 🍌 The north-eastern boundary is formed by the Ozleworth Brook and a leat diverts off this through part of the Site. The brook is known to support otter, water vole, heron, kingfisher and dipper upstream at the Gloucestershire Wildlife Trust Nature Reserve at Nind. 🍌 Rivers and streams are a Gloucestershire BAP priority and of high conservation importance. 🍌 In addition ditches are present alongside many of the hedgerows; these are of lower value but feed into the brook. 🍌 Potential impacts include pollution, flooding and recreational damage. 	<ul style="list-style-type: none"> 🍌 Ensure appropriate mitigation measures are in place during construction (e.g. CEMP). 🍌 Buffer the brook and leat (and associated trees) with a minimum 15m buffer (could form part of attractive POS/ green infrastructure). Allow accessible and inaccessible sections of water course, to prevent uncontrolled access to water course by the public. 🍌 Buffer smaller streams/ ditches with minimum 3m where practicable to protect water from pollution as well as allow access for management. 🍌 Create wildlife-friendly SuDS to prevent pollution incidents to water courses.
Hedgerows	<ul style="list-style-type: none"> 🍌 Species-rich and species-poor hedgerows are a Habitat of Principal Importance (S41 of NERC Act), Gloucestershire BAP habitat. Many of the hedgerows are very diverse and some contain mature standard trees. 🍌 Important ecological feature. 	<ul style="list-style-type: none"> 🍌 Retain where possible, restore and buffer (outside property boundaries) to allow future management, e.g. 2-3m. 🍌 Retain hedgerow trees. 🍌 Enhance species-poor hedgerow with additional planting. 🍌 Can form part of green infrastructure strategy. 🍌 Replace any losses and plant new native hedgerows to provide net gain.
Arable	<ul style="list-style-type: none"> 🍌 No major constraints – low ecological value. 	<ul style="list-style-type: none"> 🍌 Compensatory habitat creation required under new Biodiversity Net Gain Metric – this can be grassland (e.g. POS or other habitat).
Fauna		
Breeding birds	<ul style="list-style-type: none"> 🍌 Protected under Wildlife and Countryside Act (WCA) 1981. Potential for offence to be committed by damaging/ destroying active birds' nests. 🍌 Recommended that bird surveys are undertaken, concentrating on farmland birds and the riparian corridor to establish the presence of Schedule 1 species, such as kingfisher. 	<ul style="list-style-type: none"> 🍌 Retain trees and hedgerows that provide nesting habitat for birds. 🍌 Provide new nesting opportunities e.g. place nest boxes on retained trees and incorporate nest boxes into new buildings. 🍌 Time vegetation clearance to avoid bird breeding season (March – August inclusive) or with a check for active birds' nests.
Bats	<ul style="list-style-type: none"> 🍌 European Protected Species. Many bats are also Species of Principal Importance under the NERC Act 2006. 🍌 Site boundaries (trees and hedgerows) may be important commuting/ foraging routes. 🍌 Surveys required to establish species assemblage and site usage. 	<ul style="list-style-type: none"> 🍌 Identify key corridors for bats, retain and buffer these habitats where possible. 🍌 Avoid direct lighting of key areas during construction and operation. 🍌 Enhance site with additional roosting opportunities.

Ecological Receptor	Constraints and Likely Impacts During Construction and Operation	Recommended Mitigation, Opportunities and Enhancements
Reptiles	<ul style="list-style-type: none"> 🔥 Protected under WCA 1981. Risk of an offence being committed (killing/ injury of reptiles) during vegetation clearance, particularly along the stream corridor and at hedgerow bases. 🔥 Surveys required to establish presence/ absence. 	<ul style="list-style-type: none"> 🔥 Enhance site to increase the value for reptiles e.g. habitat enhancement such as rough grassland, ponds and log piles.
Invertebrates	<ul style="list-style-type: none"> 🔥 The water courses and hedgerows are likely to support common/ widespread invertebrates and potentially some notable species. 🔥 Ideally these habitats should be retained, or suitable replacement habitats included in the design. 	<ul style="list-style-type: none"> 🔥 The buildings could incorporate a green roof and bee/bug bricks. 🔥 A range of habitats should be retained/ created within POS. 🔥 New planting schemes should include wildlife friendly species e.g. selected from the RHS Perfect for Pollinators list.
Great Crested Newt	<ul style="list-style-type: none"> 🔥 There are numerous records of great crested newt (European Protected Species) locally, including at the new development south of Charfield Road. Two ponds are shown on OS maps as being present within boundary, although they are no longer present. One pond to the south is also no longer present. There are 10 other ponds within 500m (five within 250m). 🔥 The majority of the Site provides low value foraging habitat, although the hedgerows and river edge provide higher quality commuting, foraging and refuge opportunities. 🔥 Surveys can be undertaken, followed by traditional licensing techniques, or the Stroud GCN District Licensing Scheme can be followed which requires mitigation payment rather than surveys. 🔥 If present, the development could result in a permanent loss of terrestrial habitat for this species and result in an offence under UK and EU legislation. 	<ul style="list-style-type: none"> 🔥 It may be possible to avoid surveys through the Stroud GCN District Licensing Scheme. This is an optional approach and can be expensive but will speed up the licensing process post-consent. 🔥 Alternatively, surveys of surrounding ponds will need to be undertaken, and appropriate mitigation undertaken on site – for example including high quality terrestrial habitat and ponds providing wildlife corridors. A licence from Natural England may be required for vegetation removal. 🔥 New ponds could be included as part of SuDS to provide an enhancement.
Dormouse	<ul style="list-style-type: none"> 🔥 European Protected Species. The site provides good quality hedgerows for this species and there are known records within 2km (EPS mitigation licence, shown on MAGIC). Surveys required to establish presence/ absence. 🔥 If present, a licence from Natural England is likely to be required for hedgerow removal. 	<ul style="list-style-type: none"> 🔥 Avoid removal of hedgerows and woodland. 🔥 If present, mitigation will involve additional hedgerow/ woodland planting and timing constraints to vegetation removal.
Otter/ water vole	<ul style="list-style-type: none"> 🔥 Otter are a European Protected Species. Water vole are protected via the Wildlife & Countryside Act 1981 (as amended) – both are known to be present on the Ozleworth Brook, at Nind Nature Reserve upstream. Surveys required to identify resting/ breeding sites. 🔥 Presence of this species may impact design and result in timing constraints. 	<ul style="list-style-type: none"> 🔥 Buffer the stream corridor to avoid disturbance of riparian mammals. 🔥 Any key areas e.g. holts should be protected from human/ dog disturbance by restricting access.

Table 2: Biodiversity Metric Indicative Baseline Calculations (Habitats)



















Habitat Distinctiveness	Habitats on Site	Current Condition	Units on Site	Requirements to Deliver Gain	Likely Delivery
Very Low				Compensation not required	
Low	<ul style="list-style-type: none">  Arable fields  Improved Grassland  Bareground  Tall Ruderal Vegetation 	Poor to Moderate	56.42	Same distinctiveness or better habitat required	<ul style="list-style-type: none">  Retain some existing grassland where possible e.g. in buffers and enhance to 'good' condition through over-sowing and management.  Retain ruderal vegetation and enhance to 'good' condition by controlling and eradicating Himalayan balsam.  Create species-rich meadow (higher distinctiveness).  Create other high distinctiveness habitats e.g. scattered trees, orchard, marshy grassland, ponds and wetland.
Medium	<ul style="list-style-type: none">  Mixed Scrub  Marshy grassland 	Poor	0.12	Same broad habitat or a higher distinctiveness habitat required	<ul style="list-style-type: none">  Retain scrub and enhance to 'good' condition, or if lost replace with scrub or woodland habitat.  Retain marshy grassland and enhance/ extend through management. If lost replace with higher quality grassland (e.g. meadow) or wetland features.
High	None	N/A			
Very High	None	N/A			

Table 3: Biodiversity Metric Indicative Baseline Calculations (Hedgerows)

Habitat Distinctiveness	Habitats on Site	Current Condition	Units on Site	Requirements to Deliver Gain	Likely Delivery
Very Low	None	N/A			
Low	<ul style="list-style-type: none">  Native hedgerow (species-poor) 	Moderate to Good	5.46	Same distinctiveness band or better	<ul style="list-style-type: none">  To provide gains, enhance 'Moderate' hedgerows to 'Good' condition, or to higher distinctiveness band such as species-rich hedgerow.
Medium	<ul style="list-style-type: none">  Native species-rich hedgerow (with or without trees) 	Poor to Good	12.624	Like for like or better	<ul style="list-style-type: none">  Aim to retain these hedgerows.  Any losses will need compensation.  To provide gains, enhance 'Poor' and 'Moderate' hedgerows to 'Good' condition through management.
High	None	N/A			

NOTE – more biodiversity units are available when habitats are retained and protected during construction, and then ‘enhanced’ through management (rather than replaced). A detailed assessment will be required as the scheme develops, which will indicate the habitat areas and hedgerow lengths required to achieve the required BNG.

To achieve a 10% BNG (based on the current red/ blue line boundaries indicated in the Site Promotional Document), the Site will need to demonstrate **62.19 habitat units** and **19.89 linear (hedgerow) units**.

The above assessment was based on the assumption that the water course will not be impacted and will have a minimum 10m buffer.

6. Conclusions

The preliminary survey work has not identified any major ecological constraints to development of the site.

Whilst further surveys are required to help fully inform the emerging masterplan for the site, it is considered that the habitats of ecological value can be readily accommodated into a sensitively designed scheme. There remains ample opportunity for mitigation, compensation and enhancement measures through careful design, following the guidance given above.

Overall, it is considered that there are no significant or in-principle ecological constraints that would preclude the residential development of the site, and there is moreover the opportunity to achieve biodiversity net gain and compliance with local and national policy.

APPENDIX F – ODOUR REPORT



LAND AT KINGSWOOD, WOTTON-UNDER-EDGE, STROUD,
GLOUCESTERSHIRE.

DETAILED ODOUR IMPACT ASSESSMENT

September 2020

Report Ref: 01.0188.001/OIA v1

Isopleth Ltd.

Registered in England and Wales No. 9150373

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1.0 INTRODUCTION

Redrow has appointed Isopleth to undertake a detailed odour impact assessment of the Kingswood Wastewater Treatment Works (WwTW) with the aim of predicting any odour impact on their land to the South West of this site. The WwTW lies within the administrative authority of Stroud District Council and the Kingswood WwTW is operated by Wessex Water.

1.1 Site Description

The land of interest to Redrow lies less than 20 metres from the Kingswood WwTW site boundary and around 25 metres from the closest odour source. The site ownership boundary is shown in Appendix A.

1.2 Scope

This detailed assessment report only relates to odour from the WwTW and its constraints on the owned land and does not include assessment air quality impacts associated with construction or operation of any subsequent development, for example.

The sources of odour generation at the Kingswood WwTW have been identified and the resultant release and impact on the surrounding locality estimated, using site monitoring data and dispersion modelling techniques to determine exposure in terms of European Odour Units (ou_E/m^3).

1.3 Objectives

The objectives of this assessment are as follows:

- To predict odour impacts at the land of interest to Redrow; and
- To assess the significance of these impacts in terms of potential development constraints.

1.4 Experience of Assessor

According to guidance issued by the IAQM, odour surveys must only be completed by a qualified assessor if they are to be considered robust. This includes both experience in the field of odour assessment as well as a defined odour acuity.

This assessment has been completed by Matt Stoaling of Isopleth Ltd and Fellow of the IAQM. Matt has been involved in the field of odour assessment for over 20 years. During this time, Matt has also provided air quality and odour advice and services to a range of industry sectors and clients, including solid waste, wastewater and agriculture. Matt has worked on behalf of local authority and government agencies advising on odour issues, including documents relating to odour assessment published by the Environment Agency, Sniffer and the IAQM. The IAQM Fellowship certificate for Matt Stoaling is included as Appendix B.

2.0 REGULATORY STANDARDS AND GUIDELINES

In the UK there are no statutory numerical standards for assessing the acceptability of predicted odour impacts from quantitative odour impact assessments. On this basis, odour impact criteria are typically based upon guideline documents (predominately based on research from outside of the UK), case law and research which differ depending on the regime i.e. planning (to avoid significant detriment to amenity) or permitting (to avoid unacceptable pollution).

The numerical limits applied have largely been derived from the findings of a limited number of epidemiological assessments where modelled odour impacts have been compared to the findings of quality of life surveys; a dose-effect study. These dose-effect studies have only been undertaken for a limited number of odour types; however they have been used as the foundation for the setting of acceptable odour standards in many countries.

The actual acceptable level of impact will be dependent on the nature (offensiveness) of the odour and the broad sensitivity of the population. To account for this differing numerical limits are often set not only depending on the offensiveness of the odour but also the broad sensitivity of the environment.

2.1 The National Planning Policy Framework (NPPF)

The latest guidance published in February 2019, the National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied.

At the heart of the NPPF is a presumption in favour of sustainable development. It is described as providing a framework within which locally-prepared plans for housing and other development can be produced. It requires Local Plans to be consistent with the principles and policies set out in the Framework with the objective of contributing to the achievement of sustainable development. The following Policies are of relevance.

Under paragraph 170(e), it states that:

'127. Planning policies and decisions should ensure that developments:

.....

f) create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users⁴⁶; and where crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesion and resilience.'

Under paragraph 180, it states that:

'180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well

as the potential sensitivity of the site or the wider area to impacts that could arise from the development. '

Under paragraph 182, it states that:

'182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.'

2.2 UK Guidance

UK guidance identifies a range of odour impact criteria depending primarily on the nature of the odour (i.e. its pleasantness/unpleasantness) and the likelihood of causing unacceptable impacts based on the 98th percentile of predicted hourly average concentrations over a year. It is therefore evident that such criteria apply only to locations where an individual's exposure is likely to occur for prolonged periods of time i.e. residential properties. Where exposure is more transient (i.e. roads, footpaths etc.) the direct application of such criteria should be treated with caution and further consideration should be given to how the duration and frequency of exposure of the individual will influence the acceptability of the predicted impact.

2.3 IAQM Odour Guidance

In October 2018 the Institute of Air Quality Management released the latest version of its guidance on the assessment of odour for planning. The guidance is for assessing odour impacts for planning purposes. It provides background information relating to requirements for odour impact assessments and suitable impact criteria and draws from other sources of information such as that described in EPR H4 horizontal odour guidance.

The information provided in this guidance relating to receptor sensitivity and also impact criteria have been used in this assessment.

2.3.1 Receptor Sensitivity

The sensitivity of the receptor and therefore the degree to which a complaint is likely to arise, will differ depending on the land use. The IAQM (2018) document provides the receptor sensitivity framework overleaf.

Table 2: Receptor sensitivity to odours

For the sensitivity of people to odour, the IAQM recommends that the Air Quality Practitioner uses professional judgement to identify where on the spectrum between high and low sensitivity a receptor lies, taking into account the following general principles:

High sensitivity receptor	Surrounding land where: <ul style="list-style-type: none"> users can reasonably expect enjoyment of a high level of amenity; and people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.
Medium sensitivity receptor	Surrounding land where: <ul style="list-style-type: none"> users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or people wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Examples may include places of work, commercial/retail premises and playing/recreation fields.
Low sensitivity receptor	Surrounding land where: <ul style="list-style-type: none"> the enjoyment of amenity would not reasonably be expected; or there is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Examples may include industrial use, farms, footpaths and roads.

It can be seen that:

- Residences are regarded as being of 'high' sensitivity to odour; and
- Commercial / retail premises (for example) are regarded as being of 'medium' sensitivity to odour.

2.3.2 IAQM Odour Impact Criteria

Odours from WwTW may include sludge sources which would be regarded in relative terms as being of the highest offensiveness, and 'humic' type odours from secondary treatment (for example) which would be regarded in relative terms as being of the highest offensiveness.

Table 7: Proposed odour effect descriptors for impacts predicted by modelling – "Moderately Offensive" odours

Odour Exposure Level $C_{95}, \text{ou}_e/\text{m}^3$	Receptor Sensitivity		
	Low	Medium	High
≥ 10	Moderate	Substantial	Substantial
5-10	Slight	Moderate	Moderate
3-5	Negligible	Slight	Moderate
1.5-3	Negligible	Negligible	Slight
0.5-1.5	Negligible	Negligible	Negligible
<0.5	Negligible	Negligible	Negligible

It should be noted that the Table applies equally to cases where there are increases and decreases in odour exposure as a result of this development, in which case the appropriate terms "adverse" or "beneficial" should be added to the descriptors.

The IAQM (2018) Guidance refers to the combined odour from wastewater treatment as being of 'moderate' offensiveness. The proposed odour effect descriptors for impacts predicted by modelling of moderately offensive odours is as shown above.

In terms of the application of the above odour effect descriptors, the IAQM (2018) Guidance states the following:

'Where the overall effect is greater than "slight adverse", the effect is likely to be considered significant. Note that this is a binary judgement: either it is "significant" or it is "not significant". Concluding that an effect is significant should not mean, of itself, that a development proposal is unacceptable and the planning application should be refused; rather, it should mean that careful consideration needs to be given to the consequences, scope for securing further mitigation, and the balance with any wider environmental, social and economic benefits that the proposal would bring.'

Therefore, in relation to a high sensitivity receptor such as a residence and a moderately offensive odour such as from WwTW, an odour greater than $C_{98, 1\text{-hour}} 3 \text{ ou}_E/\text{m}^3$ would be regarded as 'moderate adverse' and therefore 'significant'.

2.4 UK Case Law (Planning)

There have been a number of planning Appeal judgments specifically in relation to the acceptability of odour from wastewater treatment on residential development; both in terms of encroachment of new housing in proximity to an existing WwTW and for new WwTW in proximity to existing housing.

Judgements such as The Fitz Cockermouth, Haverill Snooker Club and Bloor Homes Leighton Linslade for example, have accepted assessment criterion of $C_{98, 1\text{-hour}} 3 \text{ ou}_E/\text{m}^3$ and $C_{98, 1\text{-hour}} 5 \text{ ou}_E/\text{m}^3$ as being sufficient enough to safeguard residential amenity.

On 1st March 2016 the Inspectors report for the appeal relating to 'Land South of Le Neubourg Way, Gillingham, Dorset' (Appeal Ref: APP/N1215/W/15/3005513) was released. This appeal, which centred on a development north of the Wessex Water Gillingham WwTW included a significant and detailed discussion between two odour expert witnesses and the issues are described in some detail in the Inspectors report. In relation to odour criteria, the Inspector concluded the following:

'19. Taking all the above into account, I conclude that the appropriate parameter to apply in this case is the $3 \text{ OU}_E/\text{m}^3$ contour line; a more restrictive approach would preclude from development areas which are comparable in odour terms with extensive areas of existing housing in Gillingham. A less restrictive approach would permit development of areas which, in odour terms, clearly ought not to be developed.'

The limit criteria used in this assessment is discussed further in section 4.9 of this report.

2.5 Wessex Water Guidance

Wessex Water has prepared its own guidelines relating to development near WwTW:

- Odour Policy Plan. ENVS12015; and
- Odour Risk Assessment Procedure for Proposed New Development. Issue NO 4 TRTWG669, March 2019.

This guidance provides an assessment framework which Wessex Water prefer is used when the potential impacts of a WwTW on a new development are assessed.

Wessex Water has previously applied an impact criterion of between $C_{98, 1\text{-hour}} 1.5 \text{ ou}_E/\text{m}^3$ and $C_{98, 1\text{-hour}} 5 \text{ ou}_E/\text{m}^3$ as being sufficient enough to safeguard residential amenity. However, their current position, is that $C_{98, 1\text{-hour}} 3 \text{ ou}_E/\text{m}^3$ is appropriate.



3.0 ASSESSMENT METHODOLOGY

3.1 General Approach

This odour assessment has been undertaken using the concept of the European Odour Unit (ou_E), as defined in BS EN 13725. This approach allows impact assessment of any odorous gas as it is independent of chemical constituents and centres instead on multiples of the detection threshold (i.e. the physiological response of a human) of the gas in question. This approach is consistent with the requirements of Wessex Water and also for the previous odour assessments completed by Isopleth Ltd in relation to this WwTW.

As the odour unit is a Standard Unit in the same way as gram or milligram, the notation used in odour assessment follows the conventions of any mass emission unit as follows:

- concentration: ou_E/m^3
- emission: ou_E/s
- specific emission (emission per unit area): $ou_E/m^2/s$

Like air quality standards for individual pollutants, exposure to odour is given in terms of a percentile of averages over the course of a year. The exposure criteria most accepted in the UK at present is given in terms of (concentration) European Odour Units as a 98th percentile (C_{98}) of hourly averages. This allows 2% of the year when the impact may be above the limit criterion (175 hours). The notation for impact is therefore: $C_{98, 1 \text{ hour}} \times ou_E/m^3$.

3.2 Wessex Water Consultation

This assessment is based on consultation with Wessex Water and an accompanied site visit to the Kingswood WwTW on 3rd August 2020. The assessment follows the requirements of *Odour Risk Assessment Procedure for Proposed New Development* (March 2019) and inputs have been agreed with Mr [REDACTED], Regional Process Scientist (Odour and Fly Management Co-ordinator).

3.3 Quantification of Odour Impact

Emissions data agreed with Wessex Water and confirmed as appropriate has been used as input to an atmospheric dispersion model. For this assessment the AERMOD model has been used with due consideration to relevant guidance. This model is widely used and accepted by the EA and UK planning authorities for undertaking such assessments and its predictions have been validated against real-time monitoring data by the USEPA. Wessex Water prefer the use of the AERMOD model (which is a valid model as stated in the IAQM guidance) as the majority of odour modelling completed in the Wessex Water area has been completed using AERMOD and therefore makes future comparisons easier. It is therefore considered a suitable model for this assessment.

Dispersion modelling guidance indicates that at least 3 (and ideally 5) years of meteorological data should be applied to ensure that infrequent weather conditions do not unduly bias the

results. This results in a range of predicted impacts for different years of meteorological data and the average value is used to assess compliance, with the range of impacts used to assess likely variation between years and the risk of shorter-term impacts. This is particularly important in relation to odour, where acceptability of impacts is assessed by receptor over long time periods rather than as a result of infrequent or unusual meteorological conditions.

The results of the dispersion modelling have been presented in the form of:

- illustrations of the odour footprint as isopleths (contours of concentration) for the criteria selected enabling determination of impact at any locations within the study area; and
- tabulated odour concentrations ($C_{98, 1\text{-hour}} \times \text{ou}_E/\text{m}^3$) at discrete receptor locations to facilitate the discussion of results.



4.0 BASELINE ENVIRONMENT & MODEL INPUT

4.1 Development Area and Complaint History

The location of the land ownership (within the red line boundary) is shown in Appendix A.

The Kingswood WwTW is a traditional works, with inlet flows pumped to screens, primary tanks and then biotrickling filter beds. As it is a pumped works there are no flows in excess of full flow to treatment (FFT) received at the works. Sludge is held in open holding tanks (only 2 of which are currently operational) before being tankered from the site.

Wessex Water was not aware of any odour complaints that have been received from existing residential receptors in relation to emissions from the Kingswood works, although there have been reports of odour from receptors on the New Road. These reports were attributed to a pumping station which serves the works rather than the works process units themselves.

4.2 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and, hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

The WwTW facility lies on land which slopes downwards towards the potential development site (and river), with a basal elevation of around 35-45m AoD. Topography has been incorporated within the dispersion model.

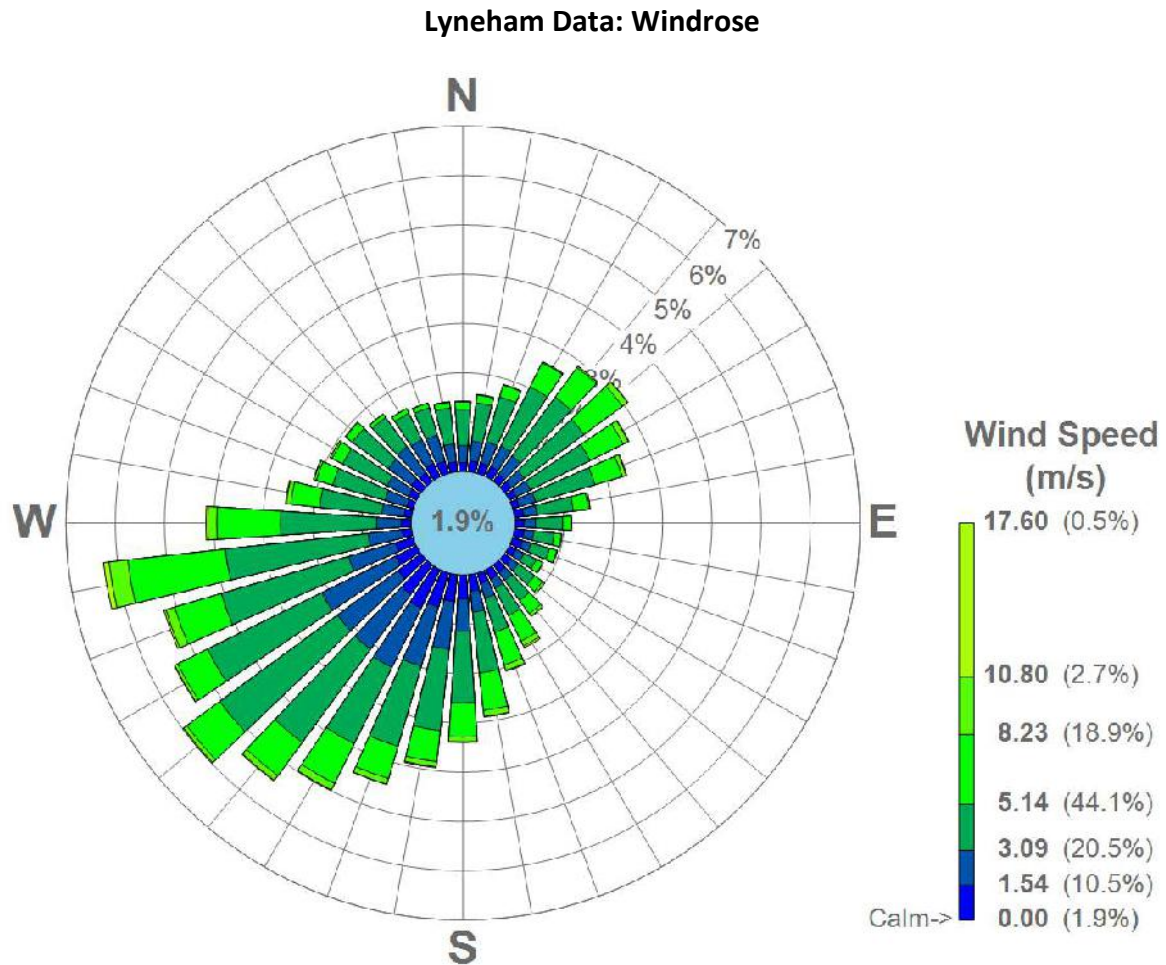
4.3 Meteorological Conditions

For meteorological data to be suitable for dispersion modelling purposes a number of meteorological parameters need to be measured on a continuous basis. There are only a limited number of sites where the required meteorological measurements are made. In the UK, all of these sites are quality controlled by the Met Office.

The closest Met Office site to Kingswood is located at RAF Lyneham. Wessex Water was consulted regarding the suitability of the RAF Lyneham data set and has confirmed that this is their preferred meteorological data set for this site due to proximity and height of ground level (mAoD). Data for the years 2014 to 2018 inclusive have been used for this assessment as showing in Figure 4-1.

It is apparent from this data that the predominant wind direction is from the SSW with very infrequent wind from the north east (i.e. from the WwTW to the proposed residence). This is as would be expected given the prevailing winds of the UK.

Figure 4-1



The AERMOD dispersion model requires the selection of a suitable data set (in this case Lyneham) and then 'preparation' of this data set using the AERMET software to account for site characteristics such as surface roughness, and albedo. The WwTW is currently surrounded by a thin band of trees, with grassland in the wider area including pasture from the WwTW to the proposed dwelling.

The surface roughness and albedo / Bowen preparation (which relies on the land use proportions over a larger area), are as follows and have been agreed with Wessex Water:

- Roughness: 0.2m;
- Albedo: 0.2664; and
- Bowen: 1.0225

4.4 Site Surroundings and Potentially Sensitive Receptors

A total of 102 receptor locations have been selected in the model to represent locations within the land ownership, as shown in Drawing AQ1, Appendix A.

Five receptor locations have been selected in the model to represent existing residences close to the Kingswood WwTW, as shown in Table 4-1, below and Drawing AQ1, Appendix A.

Table 4-1
Existing Receptors

Reference	Description	OS Xm	OS Ym
NR1	Blueboy Cottage	374110.2	192913.9
NR2	The Round House	374149.7	192969.2
NR3	Bushford House	374194.8	192976.6
NR4	Bushford Bridge Cottage	373988.1	192886.7
NR5	Hopyard farm	374275.7	192497.7
NR6	Merryford Farm	373976.7	192807.9

Impacts have also been assessed by use of a 1.05km x 1.05km grid at 30m resolution across the model domain. These results have been presented as odour impact isopleths.

4.5 Odour Baseline Conditions

Ambient odour is not a pollutant that is measured in the UK as it is not possible to accurately obtain a background concentration using standard monitoring techniques.

Wessex Water has agreed that there is no requirement for the predictive modelling to be accompanied by walkover odour audits ('sniff tests') following the IAQM procedure in this case.

4.6 Model Scenarios

A single model scenario has been assessed. In this scenario the agreed emission rates have been used which are based on UKWIR values. The rates used are specific to the Kingswood site and it should not be assumed that they are relevant to any other WwTW.

4.7 Quantification of Odour Emissions

A site schematic for the WwTW is included as Appendix C (reproduced courtesy of Wessex Water). The WwTW includes the following potentially odorous sources:

- Inlet works;
- 3 No. Primary Settlement Tanks (with distribution tank);
- 4 No. Trickling filter beds;
- 2 No. Sludge holding tanks (others disused);
- 4 No. Humus tanks; and

- holding / transfer chambers.

No seasonal variability has been applied to the specific emission rates, although in reality emissions are likely to be lower during the winter months when volatilisation will be higher and the potential development of septicity more rapid.

The modelled odour emission rates from the inlet works are presented in Table 4-2 below.

Table 4-2
Odour Emission Rates – Inlet

ID	Source	Surface Area (m ²)	Emission Rate (ou _E /m ² /s)
SS	screens skip	2.6	20.0
IC	Inlet channels	3.9	6.2
IBT1	Inlet Balance Tank 1	10.2	6.2
IBT2	Inlet Balance Tank 2	10.2	6.2
IS	inlet screens and sump	4.0	80.0

The modelled odour emission rates from primary treatment are presented in Table 4-3 below.

Table 4-3
Odour Emission Rates – Primary Treatment

ID	Source	Surface Area (m ²)	Emission Rate (ou _E /m ² /s)
PSTDT	PST Distribution Tank	3.0	100.0
PSTDS1	PST desludge well 1	1.4	140.0
PSTDS2	PST desludge well 2	1.4	140.0
PST3	Primary Tank 3	28.3	2.0
PST2	Primary Tank 2	28.3	2.0

The modelled odour emission rates from the sludge sources are presented in Table 4-4 below.

Table 4-4
Odour Emission Rates – Sludge and Returns

ID	Source	Surface Area (m ²)	Emission Rate (ou _E /m ² /s)
SST1	Sludge Settling Tank 1	112.5	140.0
SST2	Sludge Settling Tank 2	112.5	140.0
BBSPS	Bushford Bridge SPS	8.0	100.0

The site exports sludge via vacuum tanker on an irregular basis. These emissions have not explicitly been included within the model although it could be assumed that by incorporating the open sludge tank, transfer and liquors return as a continuous source the odorous emissions from this location are appropriate.

The modelled odour emission rates from the trickling filter beds are presented in Table 4-5 below.

Table 4-5
Odour Emission Rates – Biotrickling Filters

ID	Source	Surface Area (m ²)	Emission Rate (ou _E /m ² /s)
DOSE1	filter distribution 1	9.0	2.0
DOSE2	filter distribution 2	9.0	2.0
FIL4	FIL1 04	380.1	1.5
FIL3	FIL1 03	380.1	1.5
FIL2	FIL1 02	380.1	1.5
FIL1	FIL1 01	380.1	1.5

The modelled odour emission rates from the final treatment stages (humus tanks) are presented in Table 4-6 below.

Table 4-6
Odour Emission Rates – Final Treatment

ID	Source	Surface Area (m ²)	Emission Rate (ou _E /m ² /s)
HT4	humus tank 4 (square)	10.2	0.7
HT3	humus tank 3 (square)	10.2	0.7
TAN1	empty centre tank (square)	9.0	0.0
HT1	Humus Tank 1	28.3	0.7
HT2	Humus Tank 2	28.3	0.7

The overall site odour emissions and the relative contribution of each source group, is presented in Table 4-7 below.

Table 4-7
Site Odour Contribution

Source	Emission (ou _E /s)	% of total
Inlet Works	283.2	0.8%
Primary Settlement Tanks	861.6	2.4%
sludge	32300.0	90.1%
Filter Beds	2316.8	6.5%
Humus Tanks	69.6	0.2%
total	35831.2	100.0%

This site contribution is dominated by the odour emissions from the sludge sources, particularly the 2 No. sludge holding tanks to the north east of the works. There are additional tanks at the site which are currently out of use but could be brought back into use in the future if refurbished.

4.8 Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated point source to be displaced and dispersed rapidly towards the ground, resulting in higher ground level concentrations. Building downwash should always be considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which within a distance defined as five times the lesser of the height or maximum projected width of the building. There are no point sources (such as odour control stacks) at the WWTW.

4.9 Assessment Criteria: Limits

The objective of the assessment is to determine the potential extent to which unacceptable levels of odour impact could reasonably be expected to occur as a result of emissions from the site. Consideration should be given to all of the FIDOL factors, particularly frequency and duration in the case of amenity receptors.

As it is not known how the landowners would develop the plot, it is appropriate to apply criteria for high sensitivity receptors (such as residences) as well as receptors of medium sensitivity.

4.9.1 Residences

An odour limit criterion of $C_{98,1\text{-hour}} 3\text{ou}_E/\text{m}^3$ is considered reasonable / appropriate in this case for residential receptors, which are regarded as 'high sensitivity receptors'. At this level it is likely that odour will be detected, however the IAQM Guidance states that at this level it is unlikely that a Statutory Nuisance will be caused. Above a level of $C_{98, 1\text{-hour}} 5\text{ou}_E/\text{m}^3$ Nuisance may be established.

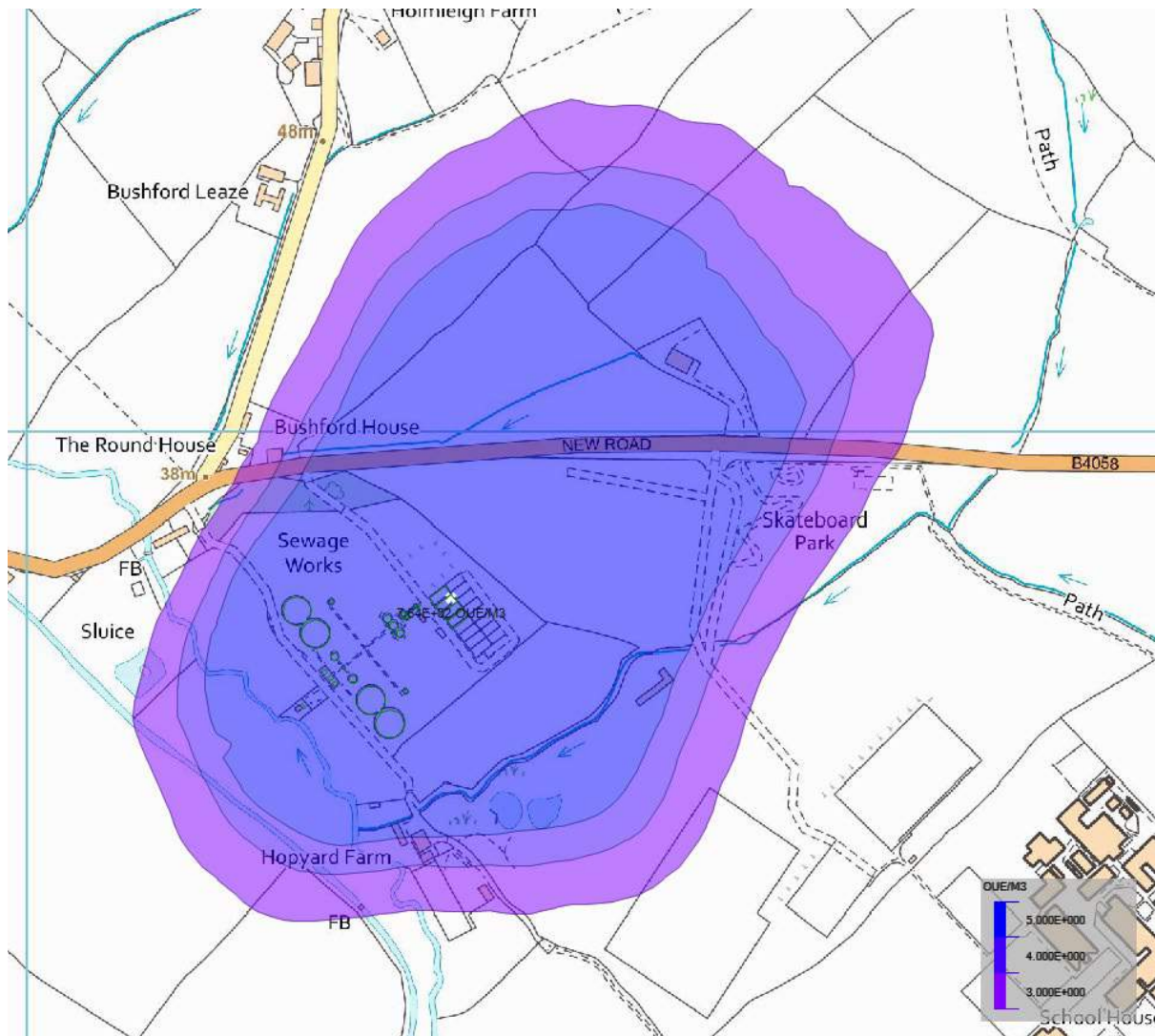
4.9.2 Other receptors

A less stringent odour limit criterion of $C_{98,1\text{-hour}} 5\text{ou}_E/\text{m}^3$ is considered reasonable / appropriate in this case for receptors of 'medium' sensitivity such as workplaces. At this level it is likely that odour will be detected, however the IAQM Guidance states that at this level it is unlikely that a Statutory Nuisance will be caused. Above a level of $C_{98, 1\text{-hour}} 10\text{ou}_E/\text{m}^3$ Nuisance may be established for these receptors

5.0 PREDICTED IMPACTS

The results of the detailed dispersion modelling assessment are presented in Appendix D, table D-1 for the receptors within the land ownership boundary. Isoleths of impact are also shown in Figure 5-1, below which shows the $C_{98,1\text{-hour}}$ 3, 4 and 5 ou_E/m^3 isopleths for the 5 year average impact.

Figure 5-1
5-year average odour impact



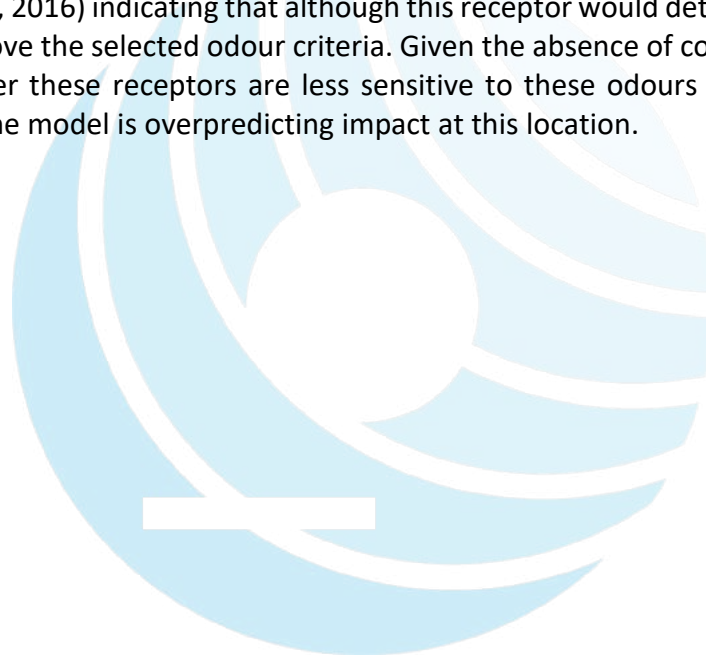
The results of the assessment indicate that, based on the input data used in the model, the average odour impact associated with the WwTW is less than the limit of $C_{98,1\text{-hour}}$ 3 ou_E/m^3 at all locations within the potential development site except for those closest to the WwTW.

The results of the detailed dispersion modelling for the existing residential receptors.

Table 5-2
WWTW: Predicted Odour Impact ($C_{98,1\text{ hour}} \text{ ou}_E/\text{m}^3$)

	2014	2015	2016	2017	2018	2014-18
NR1	2.3	2.4	3.0	2.0	2.8	2.4
NR2	2.4	2.6	3.0	2.2	2.7	2.6
NR3	3.4	4.3	4.4	3.6	3.6	3.8
NR4	0.9	1.2	1.4	0.8	1.1	1.1
NR5	1.6	1.2	1.5	1.0	1.4	1.3
NR6	1.1	1.4	1.9	0.9	1.3	1.3

The results of the assessment indicate that the odour impact associated with the WwTW is less than the limit of $C_{98,1\text{-hour}} 3 \text{ ou}_E/\text{m}^3$ at existing properties other than NR3 (Bushford House) when all 2 sludge holding tanks are in operation. The maximum impact at an existing dwelling is $4.4 \text{ ou}_E/\text{m}^3$ (NR3, 2016) indicating that although this receptor would detect odours from the works and it is above the selected odour criteria. Given the absence of complaints this would indicate that either these receptors are less sensitive to these odours than the 'standard' receptor or that the model is overpredicting impact at this location.



6.0 CONCLUSIONS

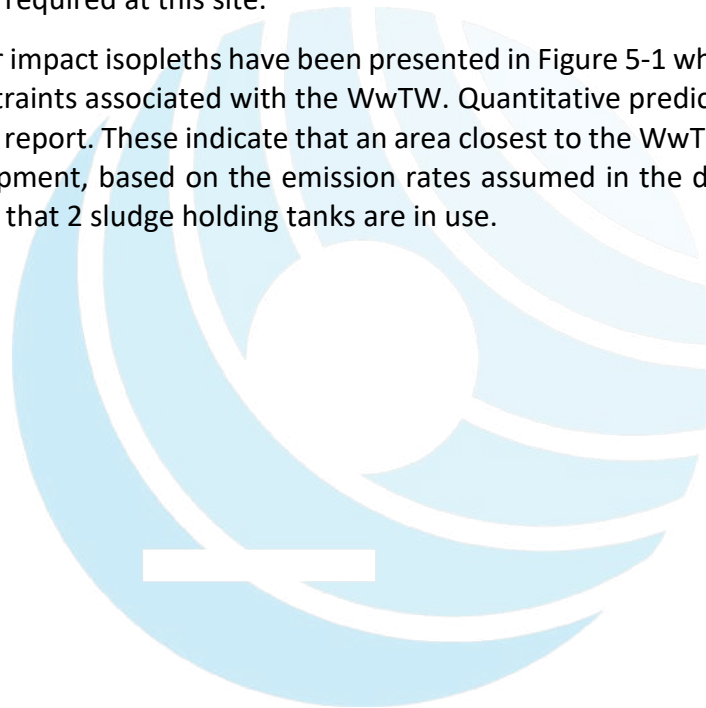
This report presents a detailed odour impact assessment (OIA) of the Kingswood Wastewater Treatment Works (WwTW), particularly in relation to the potential for impact at land of interest to Redrow.

The assessment has been completed using information provided by Wessex Water and obtained during an audit of the works. This includes:

- a list of odour sources on the site;
- dimensions of all process units; and
- Emission rates for each of the sources.

Wessex Water has confirmed that walkover odour audits ('sniff tests') following the IAQM procedure are not required at this site.

The average odour impact isopleths have been presented in Figure 5-1 which show the extent of the odour constraints associated with the WwTW. Quantitative predictions are presented in Section 5 of this report. These indicate that an area closest to the WwTW is constrained for residential development, based on the emission rates assumed in the dispersion modelling and also assuming that 2 sludge holding tanks are in use.



Notice:

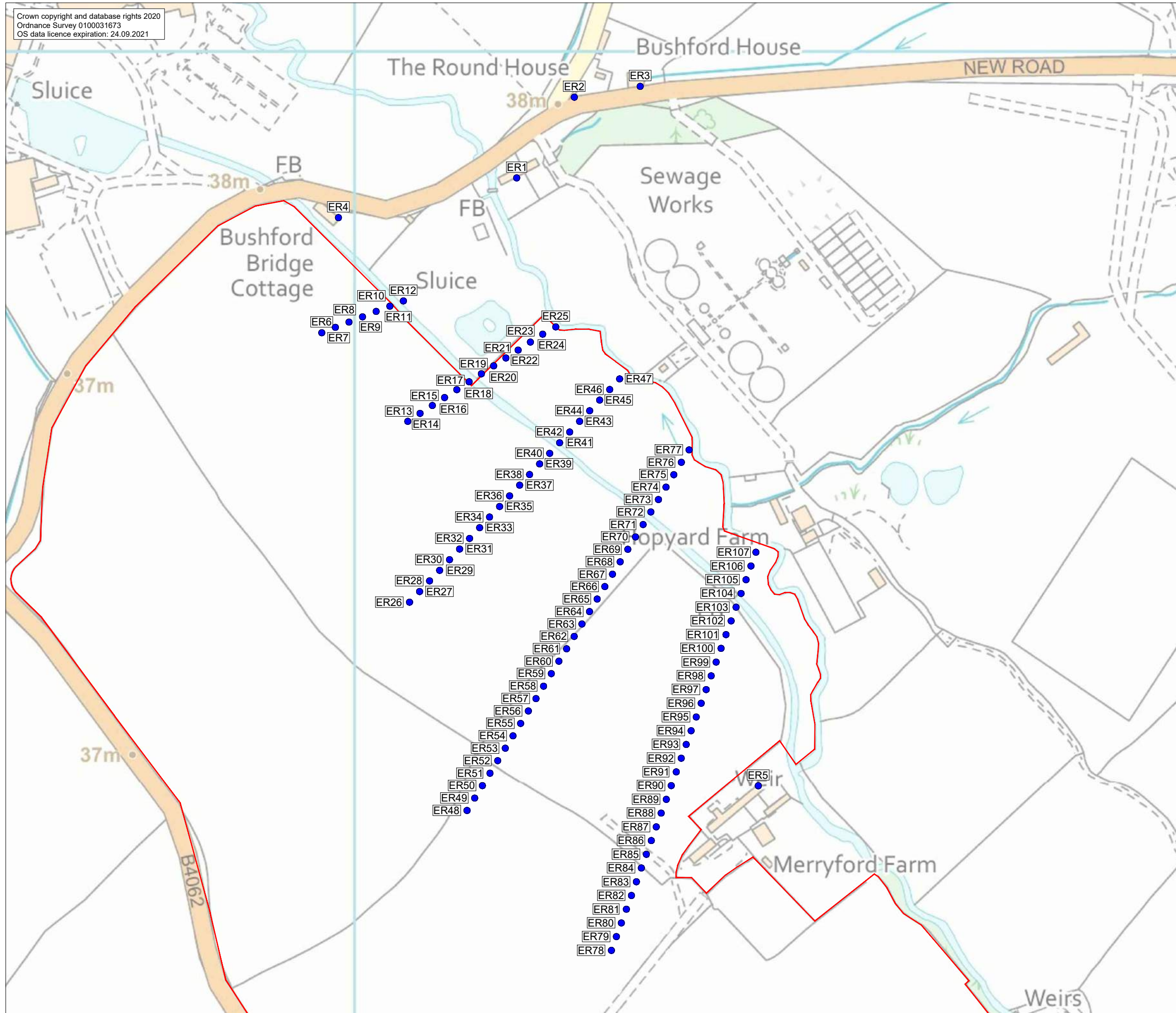
This report was produced by Isopleth Ltd to present the results of an odour impact assessment for a proposed development on land at Kingswood, Gloucestershire.

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APPENDIX A



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LEGEND

- SITE BOUNDARY
- RECEPTOR LOCATION

Redrow	
SITE Kingswood, Wotton under Edge	
PROJECT Air Quality Assessment 01.0188.001	
DRAWING TITLE Assessment Receptors	
DRAWING NUMBER AQ1	REVISION 0
SCALE 1:2500 @ A3	DATE 28.09.2020

APPENDIX B



Mr [REDACTED]

has been elected for membership of the Institute of Air Quality Management, having satisfied the entry criteria laid out by the committee of the IAQM. Therefore the application review panel have recommended:

Fellowship

and the holder may now use the post-nominal letters FIAQM

[REDACTED]

[REDACTED]

Chair of the IAQM

August 2012



Institute of
Air Quality
Management

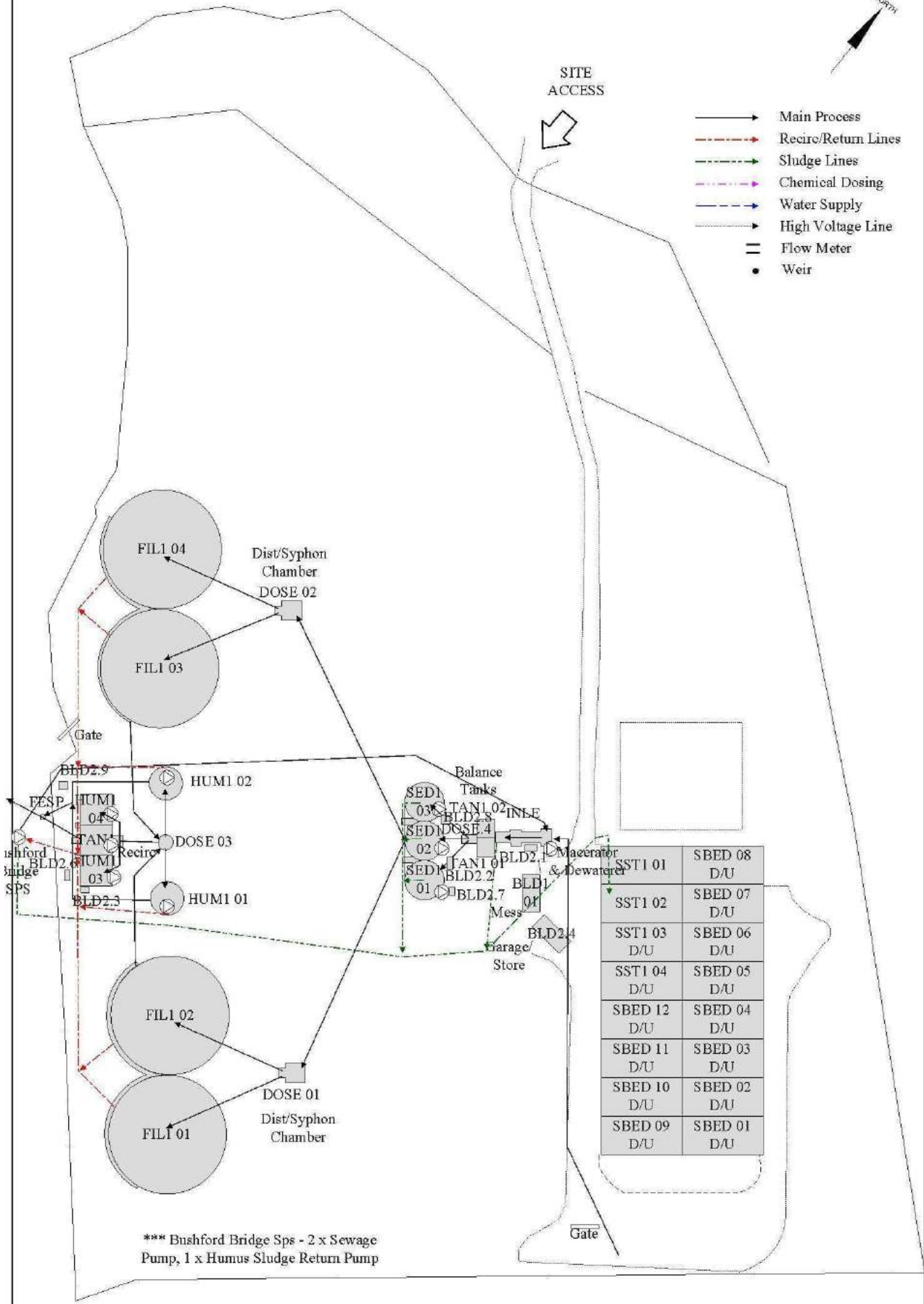


APPENDIX C





- Main Process
- - - - - Recirc/Return Lines
- · - · - Sludge Lines
- · - · - Chemical Dosing
- · - · - Water Supply
- · - · - High Voltage Line
- ▬ Flow Meter
- Weir



*** Bushford Bridge Sps - 2 x Sewage Pump, 1 x Humus Sludge Return Pump

APPENDIX D

The results of the assessment at the receptor locations modelled (as showing in Appendix A) are as follows:

Table D-1
WwTW: Predicted Odour Impact ($C_{98\ 1\ \text{hour}}\ \text{ou}_E/\text{m}^3$)

	2014	2015	2016	2017	2018	2014-18
NR7	1.2	1.5	1.9	0.9	1.4	1.4
NR8	1.2	1.6	2.0	1.0	1.4	1.5
NR9	1.3	1.7	2.2	1.1	1.6	1.6
NR10	1.3	1.8	2.2	1.1	1.6	1.6
NR11	1.4	1.9	2.3	1.2	1.7	1.7
NR12	1.5	2.0	2.4	1.3	1.8	1.8
NR13	2.0	2.0	2.9	1.6	2.1	2.1
NR14	2.1	2.1	3.0	1.6	2.2	2.2
NR15	2.2	2.3	3.2	1.7	2.4	2.4
NR16	2.3	2.4	3.4	1.9	2.5	2.6
NR17	2.4	2.6	3.6	2.0	2.7	2.7
NR18	2.6	2.8	3.9	2.1	2.8	2.9
NR19	2.8	3.1	4.3	2.3	3.0	3.1
NR20	2.9	3.3	4.5	2.4	3.2	3.3
NR21	3.2	3.7	4.9	2.6	3.5	3.6
NR22	3.4	3.9	5.3	2.8	3.8	3.8
NR23	3.7	4.2	5.8	3.1	4.1	4.2
NR24	3.9	4.6	6.0	3.4	4.4	4.5
NR25	4.4	4.9	6.7	3.6	4.9	4.9
NR26	1.6	1.6	2.1	1.0	1.8	1.7
NR27	1.7	1.7	2.1	1.1	1.9	1.8
NR28	1.8	1.8	2.2	1.1	2.0	1.8
NR29	1.9	1.8	2.4	1.2	2.0	1.9
NR30	2.0	2.0	2.5	1.3	2.2	2.0
NR31	2.1	2.1	2.7	1.3	2.3	2.1
NR32	2.2	2.2	2.8	1.4	2.4	2.3
NR33	2.3	2.3	2.9	1.5	2.5	2.4
NR34	2.4	2.5	3.1	1.6	2.6	2.5
NR35	2.6	2.6	3.3	1.8	2.8	2.7
NR36	2.7	2.8	3.5	1.9	3.0	2.8
NR37	2.9	3.0	3.7	2.0	3.1	3.0
NR38	3.1	3.1	3.9	2.2	3.3	3.2
NR39	3.3	3.3	4.2	2.4	3.6	3.5
NR40	3.6	3.5	4.6	2.6	3.8	3.7

	2014	2015	2016	2017	2018	2014-18
NR41	3.9	3.8	5.0	2.9	4.1	4.0
NR42	4.3	4.2	5.5	3.2	4.4	4.4
NR43	4.7	4.6	6.1	3.5	5.0	4.9
NR44	5.3	5.0	6.7	4.0	5.4	5.4
NR45	6.0	5.5	7.5	4.6	6.1	6.1
NR46	6.7	6.5	8.7	5.6	7.0	7.0
NR47	7.7	7.9	10.4	6.8	8.2	8.3
NR48	1.3	1.2	1.6	0.7	1.4	1.2
NR49	1.3	1.3	1.7	0.8	1.4	1.3
NR50	1.4	1.3	1.7	0.8	1.5	1.3
NR51	1.4	1.4	1.8	0.8	1.5	1.4
NR52	1.5	1.4	1.9	0.9	1.6	1.4
NR53	1.6	1.5	2.0	1.0	1.7	1.5
NR54	1.7	1.5	2.1	1.0	1.7	1.6
NR55	1.7	1.6	2.2	1.1	1.8	1.6
NR56	1.8	1.7	2.3	1.1	1.9	1.7
NR57	1.9	1.8	2.3	1.2	2.0	1.8
NR58	2.0	1.9	2.4	1.2	2.1	1.9
NR59	2.1	2.0	2.6	1.3	2.2	2.0
NR60	2.2	2.0	2.7	1.4	2.4	2.1
NR61	2.4	2.2	2.8	1.5	2.5	2.2
NR62	2.5	2.3	3.0	1.6	2.6	2.4
NR63	2.7	2.4	3.1	1.7	2.8	2.5
NR64	2.8	2.6	3.3	1.8	3.0	2.7
NR65	3.0	2.7	3.5	1.9	3.1	2.9
NR66	3.2	2.9	3.7	2.0	3.3	3.1
NR67	3.4	3.1	4.0	2.2	3.5	3.3
NR68	3.7	3.3	4.3	2.3	3.8	3.5
NR69	3.9	3.6	4.6	2.5	4.1	3.7
NR70	4.2	3.9	5.0	2.7	4.4	4.0
NR71	4.5	4.1	5.4	3.0	4.6	4.3
NR72	4.9	4.5	5.8	3.3	5.0	4.7
NR73	5.3	4.9	6.3	3.6	5.4	5.1
NR74	5.7	5.3	6.8	3.9	5.8	5.5
NR75	6.2	5.8	7.5	4.3	6.3	6.0
NR76	6.8	6.4	8.4	4.8	7.0	6.7
NR77	7.5	7.2	9.4	5.5	7.8	7.5
NR78	1.1	0.9	1.0	0.5	0.8	0.8
NR79	1.1	0.9	1.1	0.6	0.9	0.9
NR80	1.2	0.9	1.1	0.6	0.9	0.9
NR81	1.2	1.0	1.2	0.6	1.0	1.0

	2014	2015	2016	2017	2018	2014-18
NR82	1.2	1.0	1.2	0.6	1.0	1.0
NR83	1.3	1.1	1.2	0.6	1.0	1.0
NR84	1.4	1.1	1.3	0.7	1.1	1.1
NR85	1.4	1.1	1.3	0.7	1.1	1.1
NR86	1.5	1.2	1.4	0.7	1.2	1.2
NR87	1.5	1.2	1.4	0.8	1.2	1.2
NR88	1.6	1.3	1.5	0.8	1.3	1.3
NR89	1.7	1.3	1.6	0.8	1.3	1.3
NR90	1.7	1.4	1.6	0.9	1.4	1.4
NR91	1.8	1.5	1.7	0.9	1.4	1.5
NR92	1.9	1.5	1.8	1.0	1.5	1.5
NR93	2.0	1.6	1.9	1.1	1.6	1.6
NR94	2.1	1.7	2.0	1.1	1.6	1.7
NR95	2.2	1.7	2.1	1.2	1.7	1.8
NR96	2.3	1.8	2.2	1.3	1.8	1.9
NR97	2.4	1.9	2.4	1.3	1.9	2.0
NR98	2.6	2.0	2.5	1.4	2.0	2.1
NR99	2.7	2.2	2.6	1.6	2.2	2.2
NR100	2.9	2.3	2.8	1.7	2.3	2.4
NR101	3.1	2.4	2.9	1.8	2.4	2.5
NR102	3.3	2.6	3.1	1.9	2.6	2.7
NR103	3.5	2.8	3.4	2.1	2.8	2.9
NR104	3.7	3.0	3.6	2.2	3.0	3.1
NR105	4.0	3.3	3.9	2.4	3.3	3.4
NR106	4.4	3.6	4.2	2.6	3.5	3.6
NR107	4.6	3.9	4.6	2.9	3.9	3.9



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APPENDIX G – SCHOOL CAPACITY REPORT

Education Property Consultancy

Introduction

1. This report is commissioned by Redrow Homes to present an analysis of the existing pupil capacity in the Wotton cluster of 5 primary schools, as defined by Gloucestershire County Council (GCC) in its School Places Strategy (2018-2023)¹, and to present a potential long term solution to the school infrastructure requirements.

Current situation

2. The Table below presents the picture as it was in the last academic year. When pupil numbers for the current academic year become available it will be updated. It clearly shows that there is little spare capacity across the cluster as a whole with none available at Kingswood Primary School (KPS) and North Nibley C of E Primary School.

Primary School	Postcode	Distance from Kingswood ¹	Capacity	Number on Roll ²	Spare capacity
Kingswood	GL12 8RN	100 yards	119	119	-
Blue Coat C of E	GL12 7BD	1.05 miles	315	296	19
The British	GL12 7JU	2.54 miles	210	167	43
Hillesley C of E	GL12 7RH	2.40 miles	56	37	19
North Nibley C of E	GL11 6DL	3.49 miles	105	110	-5
Total			805	729	76

¹ The distances have been measured from the junction of Charfield Road (B4062) with Wotton Road (B4060) and Old Rectory Road in Kingswood village.

² This was the number of pupils on roll at January 2020 ie. the previous academic year.

The impact of additional housing

3. The Table above focusses on Kingswood village because KPS is full, and there is no scope for increasing its capacity. A development of 51 new dwellings has recently been completed to the

¹ (<https://www.gloucestershire.gov.uk/media/2085281/gloucestershire-school-places-strategy-2018-2023-final-web.pdf>)

south-west of the village, which could generate an additional 21 primary age children² and will mean that KPS will become over-subscribed. (An over-subscribed school is one where there are more applicants for places in the YR [Reception year of entry] Year Group than the number of available places (the Published Admission Number) [PAN].

4. Furthermore, there are currently two pending planning applications for new houses relatively close to the School. One, S.20/0887/FUL (land at Cloverlea Barn, Wickwar Road), is for 58 units (which could be expected to produce about 24 additional primary age children if it is approved and when completed) and the other, S.20/1083/OUT (land south of Charfield Road), is for 50 units (an additional 21 children if approved). These proposals have prompted the Chair of Governors of KPS to write a letter objecting to both developments and requesting that the proposals be refused on the grounds that the School cannot cope with more children. However, it is believed there is an imperative to permit more housing in the District and in and around Kingswood and Wotton in particular, given the sustainable nature of these settlements which have a range of everyday facilities and a major employment source in the vicinity.
5. An interim solution to this primary school infrastructure problem would be to take advantage of the (fairly minimal) spare capacity in one of the other schools in the cluster. The distances in the Table show how far children would have to travel to a school with spare capacity, if they are unsuccessful in gaining a place at KPS – which would be their local school. A better permanent solution is required so that children can be educated in their local community rather than further afield, which also increases travel time for parents.

Possible long term solution

6. KPS is a small school on a confined site. From a curriculum and a financial point of view it would benefit from an increase in size to accommodate more children but this cannot happen on its existing site due to physical and land ownership constraints.
7. It is preferable if primary schools operate in whole forms of entry (FE) so that children of the same age can be taught in the same group. This requires at least 7 classrooms with associated ancillary facilities to support a PAN (Published Admission Number) of 30 (1FE). However, the ideal size for a primary school is generally regarded as 2FE with a capacity for 420 children.
8. In order to achieve either of the above preferences, a site would need to be available to GCC, as the local education authority, to re-locate KPS to new buildings with increased capacity.
9. Neither of the current proposers for new development, referred to in para. 4 above, can offer this possibility. There are also 3 other housing developers holding option agreements on land which they could promote for more housing in the Kingswood village area. It is believed that only one, however, would have the ability to offer a suitable area of land (GCC's preferred size of 2 hectares [ha]) on which a re-located KPS could be established with scope to be able to further increase in size up to a 2FE primary school.
10. This offer (2 ha. land for re-located and enlarged KPS) could be made by Redrow Homes who have an option agreement on land north of Charfield Road just west of the village. The offer would be made viable with a new development of up to 300 dwellings. This would provide a

² The calculation, used throughout this report, of the number of primary age children likely to be generated from a new housing development is 41 pupils per 100 dwellings. This is the current GCC pupil product based on data collected in 2018 and 2019 (Appendix 2, GCC Local Development Guide Update Consultation Draft – April 2020)

permanent solution to the cluster's infrastructure problem.

11. It would be for GCC, in conjunction with the Governing Body of KPS, to establish the initial size of a re-located KPS and that would be dependent on planning approvals. From the Table above, KPS has a current capacity of 119. A 300 dwelling development could be anticipated to 'generate' about 123 new primary age residents. From the proposed developments at para. 4, there could be a further 24 + 21 additional new children so that could already be as many as 308 (119 + 189 from the Table below) children before other proposed developments are considered.

Current and proposed developments	KPS current capacity	KPS current NOR* + additional	KPS surplus (+) / deficit (-)
Existing situation	119	119	0
Completed development (51 units SW of village)	119	+ 21	-21
Pending Application at Cloverlea Barns	119	+ 24	-45
Pending Application south of Charfield Road	119	+21	-66
Proposed development north of Charfield Road (300 dwellings)	119	+123	-189

*NOR – number on Roll

12. Therefore, a proposal, which includes new school buildings with scope to expand to a full 2FE (capacity 420 pupils), would seem to be most appropriate to address a current infrastructure issue and one which will become more acute as developments continue to be built in this location.



December 2020